

THE MORPHOLOGY OF THE MUSCLES OF THE
SHOULDER-GIRDLE IN MONOTREMES.

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(Plates XX.-XXIII.)

The observations contained in this paper were made in the Anatomical Laboratory of the Medical School of the Sydney University. The subject was suggested to me by my friend and former teacher Professor J. T. Wilson, who not only allowed me to work in his private laboratory, but also supplied me with abundant material. I take this opportunity of thanking him, not only for the material, but for his advice throughout the work; and if this paper has any merit it is entirely owing to his guidance and teaching. I do not, however, wish it to be understood that the opinions herein expressed are necessarily those that Professor Wilson holds.

I have to thank Professor Haswell for a fresh specimen of *Ornithorhynchus*, which he was good enough to present to me. I am also indebted to Mr. J. J. Fletcher for the loan of Coues' paper on *Ornithorhynchus*.

With regard to the literature on the myology of the Monotremes, I have been able to consult all the chief papers with the exception of one by Fewkes (5).

Of the various writers who have contributed to our knowledge of the subject, Meckel (13) was the first to publish, in 1826, a complete description of the muscles of *Ornithorhynchus*. His work, written in Latin, will ever remain as a book of reference.

Cuvier added to our knowledge by his dissections, as also did Owen (15). In the work by Cuvier and Laurillard, published in 1849, are to be found many excellent illustrations of the muscles of *Ornithorhynchus* (4). Coues (3), working in America, wrote in 1871 a monograph on the myology of this animal, and his views are interesting, since, with the exception of Owen's short account in Todd's Cyclopædia, he had seen no previous works on the muscles of this animal, and indeed had Coues not been influenced by Owen, it is probable that he would in several cases have assigned to the muscles a more correct homology than he did.

Westling (20) in 1884 published a paper on the nerves to the fore and hind limbs of this animal, and this seems to have been the first paper which dealt in detail with the nerve supply to the limb muscles.

With regard to *Echidna*, no important paper on the myology of this animal had appeared before 1866, when Mivart (14) wrote his contribution.

In 1855 Fewkes published his paper; but, as I have mentioned above, I have not been able to see it.

The most important work on the *Echidna*, however, is that published in 1889 by Charlotte Westling (21), and, as far as I am aware, this is the only paper on the myology of this animal in which the nerve supply of the muscles is fully investigated.

Leche (12) has followed Westling, for her work appears to have been executed under his supervision.

Besides these papers there are many isolated observations scattered throughout numerous works, and in some instances I have quoted these remarks in full. The most important of them are by Fürbringer (7), Humphry (11), Testut (18), Alix (18), Smith (17), and Windle (23).

With regard to the scapula and humerus, it is not my intention to give a detailed account of these bones; but as the surfaces and borders of the scapula have received many different interpretations, I will quote here the conclusions arrived at by Professor Wilson

and myself, and published in a previous paper (22):—"If the views we have expressed are correct, then there can be little difficulty in homologising the two forms of monotreme scapula. In both forms the actual anterior border is meso-scapular. In both the prescapular part of the bone is suppressed, though in *Platypus* its site is still indicated by a ridge on the inner surface. In both scapulæ the actual posterior border is really secondary, being an exaggerated subscapular ridge, the subscapularis muscle taking origin both from the ridge itself and the bone on both sides of it. Finally, and in consequence of the last character, the postscapular border is displaced outwards and exists as a mere tricripital ridge upon the outer surface of the flat bladebone."

Again, with regard to the humerus, the view that I have taken with regard to its surfaces and borders will best be understood by reference to Figs. 18 and 19 with the accompanying description.

Lastly, I have found that many different formulæ have been given for the vertebræ and ribs of *Echidna*. I have collected a number of these, which I give in the subjoined table.

Authority.	Cervical.	Dorsal.	Lumbar.	Sacral.	Caudal.	Total.
BRUEHL (2).....	7	16	3	4	11	41
FLOWER AND GADOW (6)...	7	16	3	4	11	41
GIEBEL (9).....	7	16	4	3	10	40
	7	16	3	(4 ?)	11	41 (?)
	7	17	3	(4 ?)	11	42 (?)
HOWES (10).....	7	15	4	4	12	42
	7	15	3	4	11	40
	7	16	3	3	12	41
	7	16	2	4	11	40
THOMAS (19)...	7	16	4	4	?	?
	7	16	3	3	12	41
	7	17	4	3	12	43
MCKAY.....	7	15	4	4	9 (+?)	39 (+?)
	7	15	3	3	14	42
	7	15	?	?	?	?
	7	14	4	3	11	39
	7	16	3	3	12	41
	Right side { 7	17	2	4	12	42 }
Left side { 7	16	3	4	12	42 }	

M. PANNICULUS CARNOSUS.

ECHIDNA.

On the integument covering the ventral aspect of the abdomen being reflected, the panniculus comes into view. There is no difficulty in the dissection for about 4 to 5 cm. on either side of the median line, since the ventral aspect is devoid of spines; but, as we approach the lateral region, the integument is reflected with difficulty, since the bases of the spines pierce through it and end in the panniculus which sends bundles of fibres to each spine.

Starting from the postero-vertebral region, the muscular sheet runs forward and outwards, winding round the lateral aspect of the body, while more anteriorly it extends over the scapula and cervical regions and on to the forearm.

Following the muscle round the lateral aspect of the body, we then find it running as a continuous sheet over the abdominal muscles, the fibres taking an antero-posterior direction, with an inclination towards the mid-ventral line.

Arriving at about the region of the metasternum this single layer now becomes cleft into a superficial and a deep stratum.

The superficial Stratum of the Panniculus.—For convenience of description this may be subdivided into three parts (which can be actually shown to exist by a careful dissection): an internal, a median, and an external division.

The *internal* is represented by a small bundle of fibres, which springs from the internal border of the general sheet of panniculus, and which runs forward and inwards to meet a similar bundle from the opposite side in the mid-line, and together are attached to an aponeurosis in the region of the posterior part of the mesosternum.

The *middle division* (Fig. 1, *Pn. S. M.*) is much better developed, and is a broad band of muscle (connected with a similar band on the opposite side of the mid-line by a well-marked aponeurosis) which runs forward and inwards until it arrives in the region of

the presternum. Here it encounters a large gland (Fig. 1, *Gl.*) placed superficial to the sterno-mastoid. The muscular band runs over the gland and, receiving an accession of fibres (which come from the direction of the opposite epicoracoid region), the whole turns suddenly outwards and runs forward over the clavicle, here to be joined by the prolongation of the external division next to be described.

The inner border of the *external division* (Fig. 1, *Pn. S.E.*) of the superficial stratum is not sharply defined, but fades away into an aponeurosis (containing scattered muscular bundles), which connects it with the median division, and beneath which the deep stratum of the panniculus lies (*i.e.*, the *M. dermo-flexor brachii*).

As the external division runs forward it encounters the arm and forearm, and the fibres now take different directions; the innermost pursue their course forward to the clavicle, there to join the fibres of the median division, and spread out over the lateral aspect of the cervical region, and coalesce with the dorsal portion of the panniculus; the outermost fibres turn out over the olecranon, and joining the general dorso-lateral sheet run along the dorso-external border of the forearm, and are inserted on the external aspect of the distal extremity of the ulna, close to its carpal articulation, forming a *dermo-flexor antebrachii*.

Deep stratum of the Panniculus (Fig. 1, *Pn. D. 1*).—This lies between the middle and external divisions just described. Running forward for a short distance in the same plane as these divisions it sinks deeper, and passing superficial to the *P. quartus* it becomes narrow; and having pierced the thick fascia, as it approaches its insertion, it undergoes cleavage in a plane parallel to its surface. This occurs from within outwards, but the cleavage does not extend quite to the outer border, and consequently the two layers remain connected at the external border. The upper (Fig. 1 et 2, *Pn. D. 1*) of the two layers thus formed runs forward over the tendon of the *P. quartus*, and disappears under the postero-internal border of the clavicular deltoid, to be inserted on the posterior edge of the proximal third of the pectoro-deltoid

ridge. The deeper layer (Fig. 2 et 3, *Pn. D.* 11) sinks beneath the *P. major* and *P. quartus*, and is inserted by a narrow tendon on the proximal end of the antero-internal border of the pectoro-deltoid ridge. These two parts together constitute a *dermo-flexor brachii*.

Special regions and muscles.—Between the clavicular and mandibular regions the fibres have no longer an antero-posterior course, but their direction being now at right angles to the long axis of the body they encircle the neck and head, forming a superficial sheet which stretches ventral to the inter-mandibular muscles, and up over the sides of the head, being perforated for the ear and eye, and being attached to the parietal and frontal bones by aponeurosis.

M. dermo-dorsi cervicalis (Fig. 11, *D. D. C.*).—This band of muscle is displayed when the superficial layer of the panniculus and a thick layer of fascia (which lies immediately beneath the panniculus) are reflected from the postero-dorsal region. The muscle arises by tendons from the 9th, 10th, 11th ribs, the inner margin of the slip from the 11th rib being about 2·5 cm. distant from the mid-dorsal line, while the slips from the 10th and 9th ribs are further removed. These thin bands are very intimately connected with the tendons of the posterior trapezius arising from these ribs. The bands run forward and outwards, and coalescing, form a thin muscular sheet which becomes much wider as it approaches the scapula. The muscle continues its course, lying on the postero-external border of the trapezius, and passing superficially to the insertion of this muscle on the scapula, it becomes now superficial to the anterior part of the trapezius, and having reached the lateral aspect of the head and neck, the inner border of the muscle fuses with an aponeurosis which connects it with its fellow across the mid-dorsal line, while the remainder of the fibres are lost over the mastoid and squamosal regions of the skull; being placed superficial to the next division of the panniculus now to be described.

The dermo-brachio-cephalic bands arise by dorsal and ventral origins. The dorsal band arises by a flat tendon from the parietal

bone just anterior to the origin of the trapezius. Running outwards and backwards a muscular band develops, and this courses over the side of the head and neck, to be presently joined by the ventral division which arises from the malar, squamosal and posterior mandibular regions. The conjoined muscles are prolonged on to the dorsal aspect of the forearm, and there inserted on the distal third of the external border of the ulna; being thus related to the dermo-flexor antibrachii, which is placed superficial and distal to it.

ORNITHORHYNCHUS.

The panniculus has a similar arrangement, on the whole, in this animal to the muscle in *Echidna*; a few points call for notice.

The muscle is well developed, but is not by any means so thick as in the *Echidna*, and though closely connected with the integument, there is little difficulty in dissecting it off.

As we follow the ventral sheet forward the fibres have an inclination towards the mid-line; but there is no marked differentiation into divisions as described in *Echidna*. A dermo-flexor antibrachii is present attached to the distal extremity of the ulna. When the superficial layer is raised, in the region of the axilla, it is found that a deeper layer is differentiated off, and that as it approaches the humerus this layer pierces the deep fascia, and cleavage occurs in a plane parallel to its surface, a superficial, middle and deep layers being the result. (Fig. 5, *Pn. S.*, *Pn. D. i.*, *Pn. D. ii.*) The superficial layer (of the deep stratum), lying above the tendon of the P. major, is inserted on the middle third of the outer border of the pecto-deltoid ridge; and also, as Smith (17) has pointed out, on to the outer part of the tendinous intersection of the P. major (see *post*). The middle (Fig. 6, *Pn. D. iii.*) division, hidden by the superficial, runs inwards and is inserted on to the tendon of the P. major; being intimately connected with the terminal fibres of the P. quartus. The deep division (Fig. 6, *Pn. D. ii.*) runs inwards, and approaching the outer border of the P. major forms an inverted Λ with that muscle, a tendinous intersection intervening between the muscular fibres

of the two ; it then has insertion on the distal part of the pectoro-deltoid ridge.

Special Regions and Muscles.

The Hyo-dermal slip.—As the superficial layer of the panniculus runs over the ventral aspect of the cervical region, there is developed a well marked band of muscle on either side from its deep (dorsal) surface. These bands run forward and inwards, and piercing the fascia of this region, are inserted in the basi-hyoid close to the median line.

M. dermo-dorsi cervicalis (Fig. 12, *D. D. C.*).—This muscle arises from the 11th, 12th, and 13th ribs ; the inner margin of the slip from the 11th rib being placed about 1.5 cm. from the mid-line, while the more posterior slips are placed further out (the opposite condition holding in *Echidna*). These slips run forward and outwards, and coalescing, form a flat band of muscle which lies on the postero-external margin of the trapezius. Running forward the band becomes narrow, and passing over the insertions of both divisions of the trapezius on the scapula, the inner fibres of the muscle now become connected with an aponeurosis which stretches over the mid-dorsal line to the fellow muscle on the opposite side ; while the terminal fibres are lost in the orbital regions.

The dermo-brachio-cephalic bands arise in two parts as in *Echidna*. The dorsal band has origin from the well marked depression on the parietal bone, immediately anterior to the origin of the trapezius. The ventral part arises from the superior maxilla and processus alveolaris, and ventrally by an aponeurosis which stretches over the inter-mandibular muscles. The ventral divisions run backwards over the buccal pouch, and after being joined by a slip attached to the hyoid bone, coalesce with the dorsal portion forming a figure like the letter Y ; the auricle being placed in the fork of the Y. The united muscles are now continued as a long thin band to be inserted on the distal third of the external border of the ulna ; being placed as in *Echidna* beneath the dermo-flexor antibrachii.

Innervation. Lateral cutaneous nerve of the thorax (Fig. 13, 54, *Echidna*; fig. 16, 54, *Ornithorhynchus*). Also branches from the i.-iv. cervical nerves (figs. 13 et 16, 10); and from the external branches of the posterior divisions of the spinal nerves.

WESTLING—*Echidna*: “Der Panniculus carnosus und seine tiefern Portionen werden theils von Cervicalnerven, theils von Plexus brachialis-Nerven und theils von den dorsalen Zweigen der Thoracalnerven innervirt.”

ECHIDNA.

WESTLING gives but a slight sketch of the panniculus.

MIVART gives a short account, saying—“It consists mainly of a large superficial muscular layer with certain deeper portions, and is firmly attached to the neck and tail and distal portions of the ulna,” and under the head of *P. major* he further notes that the insertion of that muscle “is superficial to the insertion of a deeper layer of the panniculus, while an outer layer of that muscle is superficial to it.”

LECHE follows Fewkes, and gives a description of the various divisions of the panniculus, as follows:—

1. *M. dermo-dorsi cervicalis* arises from the 8th-10th rib and vertebra, as well as from the aponeurosis of the *M. trapezius posterior*, and terminates by fusing with the cervical portion of the panniculus.

2. *M. dermo-flexor antebrachii* (Pars posterior *M. latissimi dorsi*, Mivart) arises from the 8th-13th rib, and is inserted along the forearm, where it becomes connected with the *M. flexor carpi ulnaris*.

3. *M. dermo-brachialis anterior* arises from the panniculus, dorsal to the origin of the preceding; and is inserted in the tuberculum majus humeri, proximal to the insertion of the *M. pectoralis major*.

4. *M. dermo-brachialis posterior* arises more from the lateral aspect than the preceding, and, splitting into four or five divisions

(Westling), is inserted in the tuberculum majus humeri by a common tendon.

Both the last-named muscles are flexors of the anterior extremity.

5-7. *MM. dermo-extensores brachiales, internus inferior et superior* arise from the panniculus in the cervical region, and run to be connected with the ulna, carpus, and panniculus, which covers these parts.

8. *M. dermo-cervicis triangularis* arises in the dorsal middle line over the fore part of the anterior dorsum of the trapezius, and is inserted into the ulna.

ORNITHORHYNCHUS.

COUES gives a full account of the panniculus, portion of which we extract:—

“*Panniculus: its special Slips and Attachments.*—An hyodermal muscle is thus formed: over the episternal bar, a curved fan or horn-shaped set of fasciculi are developed from the inner surface of the panniculus; these curve inward as they pass forward, narrowing to a definite fleshy insertion into the body of the os hyoides, on either side of its median line, in mutual apposition. A brachic-dermal is formed over the latissimus and side of the thorax generally, by a heavy reinforcement to the inner surface of the muscle of a broad fan-shaped plane growing thicker and narrower as it passes forward to definite insertion (fleshy, or by a very short tendon on the pectoral crest of the humerus, alongside the insertion of the P. major. . . . The costo-dermal fasciculus arises from the 12th-13th ribs, respectively 1' and 1½' from the backbone, and forms a long slender flat ribbon, that runs straight up the side of the body along the anterior border of the lower trapezius, underneath the main plane of the panniculus, lying upon the latissimus to the shoulder; passing just behind the elbow; widening over the shoulder, becoming then blended with the panniculus along the side of the neck, then separating again, and finally inserted into the back part of the cheek-pouch.”

OWEN gives a short account of the panniculus, and says—"The legs and the arms protrude through oblique apertures in this muscular tunic; some of the anterior fasciculi are inserted by a short tendon into the pectoral ridge of the humerus; others, still more anterior, are attached to the cranium, the lower jaw and lower lip. A strip of fibres is attached to the os hyoides; another fasciculus spreads over the cheek pouch, and assists in emptying that receptacle of the food."

SMITH gives a short account of the panniculus in *Ornithorhynchus*, but the account contains nothing of importance.

MECKEL says, towards the latter part of his description—"In thorace supremo, e regione fissuræ brachialis modo dictæ, duobus fasciculis, quorum præcipue inferior, et decursu et adhæsione presse superiorem sequens, fortissimus est, tendinibus brevibus, musculo pectorali magno junctis affigitur ossis humeri cristæ anterioris dimidio inferiori. Magis antrorsum atque introrsum, in ipso extremo thoracis anteriore e claviculæ regione, similiter in plana duo, alterum externum, communis muscoli continuationem, alterum internum profundum finditur."

"Hoc fasciculum sistit pyramidalem, pollices duos longum, inferiore extremo quatuor, superiore duas lineas latum in regione ossis hyoidis cum muscoli omo- et sternohyoidei strato superficiale junctum. Ex hoc conjunctionis loco fasciculus hic, denuo dilatatus extrorsum et antrorsum tendit, maxillam inferiorem transgreditur, et in magnum tendinum tenuissimorum numerum finditur, labii inferioris duobus trientibus posterioribus insertorum. Hisce tendinibus labium hoc valide detrahitur. Fasciculus hic inferior Santoriniano conferendus videtur."

"Stratum externum sensim, ut jam diximus, maxime attenuatum; subito fibris transversis compositum collum et cranium laxè, pressius tamen parte reliqua circumdat, foraminibus ad aures oculosque ducentibus perforatum."

CUVIER and LAURILLARD give, in Plates 265-6-7, various figures of the panniculus with names attached to the differentiated portions. The part inserted in conjunction with the pectoralis major

is called dermo-humérien: the dermo-dorsi cervicalis is called dorso-occipitien; other parts are called portion dorsal, lateral, ventrale; on Plate 267 a dissection is shown of the slips going to the hyoid, and is called "thoraco-facien," while a note says r + + "Faisceau qui se détache de la partie postérieure de la poche, et qui se parte transversalement à l'os hyoïde."

MM. PECTORALIS MAJOR ET QUARTUS.

ECHIDNA: *P. major*, Mivart; *P. major*, anterior and posterior portions, Westling, Leche. ,

ORNITHORHYNCHUS: *P. major* includes clavicular portion of deltoid, Meckel, Owen, Coues, Leche, Westling, Cuvier, and Laurillard; *P. major* et *P. quartus*, S. Smith.

PECTORALIS MAJOR.

ECHIDNA.

Origin. This muscle arises from the posterior two-thirds of the ventral surface and border of the interclavicle; from the presternum, and mid-line of the mesosternum; and the anterior half of the ventro-lateral aspect of the metasternum; also from that portion of the sternal extremity of the second to the seventh rib (inclusive), that lies internal to the rectus.

Insertion. The anterior fibres of the muscle run directly outwards, the more posterior fibres run forwards and outwards, the muscle being inserted by a well marked tendon on the ventral portion of the external aspect of the greater tuberosity; having the epicoraco-humeral internal to it, while the cleft tendons of the pectoralis quartus and panniculus bound it anteriorly, distally, and posteriorly (Fig. 3, *Pt. M.*).

Relations. The anterior border of the muscle is separated from the clavicular deltoid by a slight interval in which there are some branches of blood vessels, and a small cutaneous branch of the N. supracoracoideus. More externally the clavicular deltoid hides from view the anterior edge of the pectoral. Along the mid-ventral line its origin is hidden, in great part by the sternomastoid, whilst it is separated from its fellow of the opposite side

by a slight interval. The P. quartus lies superficial to and hides from view its postero-external border, while the pectoralis itself covers part of the epicoraco-humeral, biceps, coraco-brachialis and rectus.

P. QUARTUS. (Fig. 3, *Pt. Q.*).

ECHIDNA.

Origin. This muscle arises from the posterior one-third of the ventral aspect of the metasternum, and from the anterior half of that portion of the aponeurosis of the external oblique that lies between the pubes and metasternum. Anteriorly the fibres of origin are close to the median line; more posteriorly they diverge slightly from the linea alba, and spread out into a fan-shaped sheet.

Insertion. The muscle runs forward and outwards as a thin layer, gradually becoming narrower (but thicker), and as it approaches its insertion it becomes cleft in a similar fashion to the deep stratum of the panniculus. The upper layer (Fig. 3, *Pt. Q.*) is inserted superficial (ventral) to the P. major on the external aspect of the ventral portion of the greater tuberosity; the deeper layer (Fig. 3, *Pt. Q.*), continuous at its outer border with the other, is inserted on the greater tuberosity beneath the P. major.

Relations. At its origin this muscle hides from view the anterior fibres of the large pyramidalis which is inserted on the metasternum. As it runs forward and outwards it hides portion of the rectus, and the postero-external border of the P. major; and is hidden at its insertion by the superficial layer of the deep part of the panniculus.

PECTORALIS MAJOR.

ORNITHORHYNCHUS.

Origin. This muscle is triangular in outline and arises from the ventral aspect of the transverse bar of the interclavicle at its junction with the median portion of that bone; from one-half of the ventral surface of the median portion of the interclavicle, presternum and mesosternum, and from that part of the ventral

surface of the 2nd-6th rib (inclusive), which lies internal to the rectus; and also from 1.5 cm. of the anterior portion of the linea alba and the adjacent aponeurosis of the external oblique.

I n s e r t i o n . The whole muscle is divided into anterior and posterior divisions by a tendinous intersection (Fig. 5, *Ti.*) which reaches from the presternum to a point situated a short distance from the proximal extremity of the pectoro-deltoid ridge. The anterior fibres of the anterior division run outwards, and somewhat posterior, to be attached directly to the ventral portion of the external border of the great tuberosity. The more posterior fibres of the anterior division, however, run to be inserted along the tendinous intersection, as do the anterior fibres of the posterior division, while the most posterior fibres run forwards and outwards, some to be attached by tendon to the proximal two-fifths of the pectoro-deltoid ridge, others to coalesce with the deep layer of the panniculus, as above described.

R e l a t i o n s . The muscle is separated from its fellow by a well-marked median line throughout. The antero-external border of the anterior division of the muscle is closely related to the clavicular deltoid (Fig. 5, *Dlt. C.*), but no difficulty is experienced in differentiating the one from the other in well preserved specimens; the dividing line being a cellular interval quite apparent when the superficial and deep fasciæ of the region are removed. The border of the clavicular deltoid does not, however, distinctly overlap the pectoral as in *Echidna*. The few fibres which arise from the transverse part of the interclavicle are closely related to the inner fibres of origin of the episterno-cleido-mastoid. The postero-external border of the muscle is overlapped by the P. quartus. The muscle hides from view the same muscles as those mentioned under *Echidna*.

PECTORALIS QUARTUS. (Fig. 5, *Pt. Q.*)

ORNITHORHYNCHUS.

O r i g i n . This muscle is triangular in outline, and arises from the anterior half of the linea alba (with the exception of the

small area occupied by the P. major), and from the aponeurosis of the external oblique.

Insertion. The muscle runs forward and outwards, lying superficial to the postero-external border of the P. major. It dives beneath the upper layer of the deep panniculus, and is inserted on the superficial (ventral) surface of the tendon of the P. major, its fibres being intimately related to the median layer (Fig. 6, *Pt. Q.*) of the deep panniculus (see *ante*).

Relations. The muscle at its origin is close to its fellow of the opposite side. As it runs to its insertion it hides part of the rectus. It does not reach, nor was it inserted on, the tendinous intersection of the P. major as stated by Smith. It undergoes no cleavage.

It will be understood from the above descriptions that the disposition of the various layers of the pectorals and panniculus is as follows :—

In *Echidna* (*a*) superficial layer of panniculus ; (*b*) upper layer of deep panniculus ; (*c*) upper layer of P. quartus ; (*d*) P. major ; (*e*) deep layer of P. quartus ; (*f*) deep layer of deep panniculus.

In *Ornithorhynchus* (*a*) superficial layer of panniculus ; (*b*) upper layer of deep panniculus ; (*c*) P. quartus and median layer of deep panniculus ; (*d*) P. major, and deep layer of deep panniculus.

Innervation. P. major, Nn. cervicales, iv., v., vi., vii. P. quartus in *Echidna* from nerve to the P. major, and possibly from the lateral cutaneous of the thorax. The same for *Ornithorhynchus* (Figs. 13 et 16 ; 36, 37).

WESTLING—*Echidna* : Innervation : Nn. cervicales v. and vi. *Ornithorhynchus*, C. vii., C. viii., D. i et ii. (Fig. 17, *Pt.*)

(For further remarks on innervation see *post.*)

WESTLING—*Echidna* : “M. pectoralis major entspringt in gerader Linie vom medialen Theile des Episternum, dem Sternum, dem Processus xiphoideus und der Aponeurose des M. obliquus abdominis externus ; der Muskel besteht aus zwei ziemlich getrennten Theilen, einem vordern, kurzen und breiten, und einem hintern,

der lang und schmal ist. Der ganze Muskel inserirt am Tuberculum majus, dorsal von dem Zipfel des Panniculus carnosus, den Fewkes M. dermo-brachialis anterior genannt hat, und ventral vom M. dermo-brachialis posterior desselben Forschers. Eine claviculare Portion fehlt, scheint aber von der medialen Portion des M. deltoideus ersetzt zu sein; vergleiche die Beschreibung des letztgenannten Muskels. Innervation: Nn. Cervicales v. und vi."

LECHE follows Westling and remarks that a clavicular portion is absent, but appears to be replaced by the median portion of the deltoid.

MIVART describes the P. major as arising from the sternum, median portion of the interclavicle, "and also somewhat from the aponeurosis of the external oblique, but not at all from the clavicle, or from the lateral branches of the interclavicle."

MIVART mentions the fact that the insertion is between the layers of the panniculus. He makes no mention of P. quartus as distinct from the P. major.

OWEN says of the P. major in *Ornithorhynchus*, "the pectoralis is of very striking dimensions, the origin of the superficial portion extends from the acromion, along the sternum and linea alba almost to the pubes; a deeper-seated portion arises from the osseous sternal ribs; the fibres of both portions converge to be inserted on to the largely developed pectoral or anterior crest of the proximal half of the humerus."

SMITH gives a description of the P. major: "Prolonged inwards from the pectoral ridge of the humerus is a tendinous band passing transversely towards the mid-sternum. To the upper (anterior) border of this band and ridge the clavicular and anterior sternal fibres of the P. major radiate to be inserted, while to its lower (posterior) border are attached at its inner end the posterior sternal fibres of the pectoralis, then the P. quartus, and external to this the dermo-flexor brachialis. The P. quartus is a thin muscle arising from the fascia of the abdominal muscles, having its inner border touching the posterior edge of the P.

major, while its outer margin is contiguous with the anterior border of the dermo-flexor brachialis."

COUES says, "The pectoral major is of remarkable extent. Its origin is in a line from the acromion and whole episternal bar, and thence down the manubrium and sternum and linea alba to within a couple of inches of the pubes. Along the chest it has thick fleshy origin from the ends of the ribs as well as from the breast bone. The abdominal portion is extremely thin—thinner than the same part of the panniculus; the muscle thickens rather abruptly as it passes over the lower edge of the thorax, and there, near the median line, a slight cellular interval may occur between thoracic and abdominal portions. The chest portion is of nearly uniform and great thickness; there is no evident distinction of a deep-seated from a superficial part; but the outer half of the episternal portion and the acromial portion are together separable from the sternal portion by a slight cellular interval along a line representing the posterior border of the muscle below described as anterior part of the deltoid [epicoraco-humeral]." In a note on this last sentence, Coues says, "These portions together are in the ordinary position, and have much the appearance of a deltoid; in fact they resemble one much more than the muscle below described as anterior-deltoid [epicoraco-humeral], does."

MECKEL says—"Ex artus anterioris musculis P. major, revera maximus, præcipue longissimus est, triangularis, a clavicula acromiali et primi ossis sternalis ramo transverso fere ad symphysin ossium pubis extensus, fere totam thoracis abdominisque longitudinem explet. Margine interno cum opposito confluit, præterea dimidio anteriore, minore a costarum sternalium anteriorum sex sine interno ortus, angulo superiore et externo toti ossis brachii spinæ anticæ inseritur tendine lato et brevi, hic simul cum musculo cutaneo unitus.

CUVIER and LAURILLARD figure the pectoralis on Plate 267 as, I, grand pectoral portio sternale (sterno-humérien), which includes our clavicular deltoid; and l'idem portio costale et même ventrale, the latter being the P. quartus as described above. (For remarks on the pectoral muscles *vide* M. deltoideus.)

M. DELTOIDEUS.

ECHIDNA: *Clavicular and scapular portions*, Mivart, Westling, Leche.

ORNITHORHYNCHUS: *Clavicular portion, regarded as part of P. major*, Meckel, Owen, Coues, Leche, Westling, Cuvier and Laurillard; *Scapular portion*, all authors.

M. DELTOIDEUS.

ECHIDNA.

Origin. (a) *Acromio-clavicular portion*. This portion of the deltoid arises from the ventro-anterior face of the clavicle; from the greater part of the ventral face of the lateral arm of the interclavicle, and from the external border of the acromion. (Fig. 3, *Dlt. C.*).

Insertion. The muscle is quadrilateral in outline and runs outwards and posterior. Narrowing as it approaches its insertion it becomes cleft, in a plane parallel to the surface, into superficial and deep portions which embrace the tendon of insertion of the scapular portion of the muscle. The superficial layer of the muscle is inserted by tendon on the postero-external border of the distal two-thirds of the pectoro-deltoid ridge; while the deeper layer continuous (internally) with the superficial, has an insertion (for the most part fleshy) on the posterior face of the humerus close to and parallel with the distal part of the pectoro-deltoid ridge. In the centre of this horse-shoe-shaped insertion is placed the tendon of the scapular deltoid.

Relations. At its origin the inner portion of the muscle is hidden from view by the sterno-mastoid. The outer third of the origin is placed ventral to the insertion of the trapezius on the clavicle; while the origin from the acromion lies between the insertion of the trapezius on the one hand, and the origin of the infraspinatus on the other. The postero-internal border of the muscle is superficial to the P. major and deep part of the panniculus; the muscle also hides in great part the epicoraco-humeral, supraspinatus, and the insertion of the infraspinatus. At its insertion the muscle is related to the origin of the supinator longus and brachialis internus, and the thin tendon of origin of the

external head of the humeral part of the triceps. (Fig. 4, *Dlt. C.*)

Origin. (*b*) *Scapular portion.* (Fig. 10, *Dlt. S.*).—This muscle arises from the external edge of the anterior third of the vertebral border of the scapula, and from the upper third of the external edge of the spine of the scapula.

Insertion. The muscle, long and slender, runs downwards, outwards and posterior, to be inserted, by a narrow well developed tendon, on the posterior surface of the humerus in a depression close to the distal one-third of the pectoro-deltoid ridge; the tendon being surrounded, as mentioned above, by the horse-shoe-shaped insertion of the clavicular part.

Relations. The muscle is partly hidden at its origin by the insertion of the posterior portion of the trapezius; while it overlies the subscapularis (very slightly) and the infraspinatus.

M. DELTOIDEUS.

ORNITHORHYNCHUS.

Origin. (*a*) *Acromio-clavicular portion.*—The muscle arises from the ventral surface of the transverse portion of the inter-clavicle throughout its length (excepting the small area adjoining the median portion from which the P. major derives a few fibres of origin); and from the ventro-external surface of the acromion. (Fig. 5, *Dlt. C.*)

Insertion. The muscle, in outline a parallelogram, runs outwards and posterior. On approaching its insertion it is cleft from without inwards into a superficial and deep layer. The superficial and larger division is inserted fleshy on the distal three-fourths of the pectoro-deltoid ridge; the deep division is inserted parallel with, and just internal to, the proximal half of the upper division, on the posterior face of the humerus; a tubercle on which the scapular deltoid is inserted intervening between the two divisions. (*Dlt. C. x.* Fig. 8.)

Relations. The fleshy fibres of origin are intimately related, internally, to the episterno-cleido-mastoid, while externally

the origin is placed ventral to the insertion of the anterior part of the trapezius on the clavicle and acromion. As noted above, the antero-internal border is separated from the P. major by a cellular interval.

Origin. (*b*) *Scapular portion*.—This muscle arises from the anterior two-fifths of the external edge of the vertebral border, and slightly from the adjoining external surface of the scapula; and from the upper one-third of the outer border of the spine. (Fig. 12, *Dlt. S.*)

Insertion. The muscle, arising fleshy, runs downward and outwards. As it approaches its insertion it suddenly develops a narrow tendon, and disappearing beneath the outer border of the clavicular deltoid, is embraced between the layers of that muscle, and then becomes inserted on a tubercle situated about the midpoint of the pectoro-deltoid ridge. (Fig. 8, *Dlt. S.*)

Relations. At its origin a few fibres are placed superficial to the tendon of insertion of the posterior trapezius, but the fibres which arise from the vertebral border of the scapula are hidden by the trapezius. The origin from the spine is closely related to the insertion of the anterior trapezius. The muscle hides from view the infraspinatus and part of the origin of the long head of the triceps.

Innervation. Clavicular portion: N. axillaris and possibly a minute twig from the N. supracoracoideus. Scapular portion: N. axillaris. (Both animals).

WESTLING—*Echidna*: “N. axillaris; ausserdem giebt der Ramus cutaneus n. supracoracoidei einen sehr feinen Faden zum M. deltoideus I. ab.” In *Ornithorhynchus* Westling refers to her figure (Fig. 17, *rs.*), and states that among the branches given off from this chord is—“einen (N. suprascapularis?) für den M. infraspinatus, den obern Theil des M. pectoralis major (*i.e.*, clavicular deltoid) und den M. supraspinatus gemeinsamen Nerven, und einen (N. axillaris) für die hintere Portion der M. deltoideus.”

ECHIDNA.

WESTLING: "M. deltoideus ist in zwei nur bei der Insertion ein wenig vereinte Theile getheilt; der eine entspringt vom Acromion und dem ganzen mit der Clavicula verwachsenen lateralen Theil des Episternum; der mediale Theil dieser Portion wird vom M. sterno-mastoideus bedeckt und liegt kopfwärts vom M. pectoralis; inserirt an einer vom Tuberculum majus ausgehenden Crista."

Westling then goes on and gives a description of the scapular portion and says—"Insertion: ein lateraler Höcker auf der Crista deltoideua, mittelst einer langen Sehne, die zum Theil die erste Portion an ihrer Insertion durchbohrt." As regards the innervation, she says—"N. axillaris; ausserdem giebt der Ramus cutaneus n. supracoracoidei einen sehr feinen Faden zum M. deltoideus I ab."

LECHE follows Westling.

MIVART describes two parts, a clavicular and a scapular portion, and states that the latter is "inserted into a depression in the deltoid crest of the humerus, its tendon being implanted in the midst of the fibres of insertion of the first described [clavicular] portion of the muscle."

ORNITHORHYNCHUS.

OWEN says—"The deltoid is divided into an anterior and posterior portion. The anterior portion arises from the anterior extremity of the coracoid, and is inserted into the summit of the deltoid crest of the humerus. [This is really the epicoraco-humeral]. The posterior part arises from the anterior and superior apex of the scapula, and is inserted into the lower half of the deltoid crest."

LECHE says the clavicular portion of the deltoid is wanting, its place being taken by the clavicular portion of the P. major. He describes a scapular portion.

MECKEL describes the clavicular portion as being part of the P. major; he describes the true epicoraco-humeral as the "Pars deltoides anterior," and he describes the posterior portion of the deltoid, "sine dubio deltoides pars posterior."

CUVIER and LAURILLARD take the clavicular portion to be part of the P. major, and the posterior portion as "deltoide," or "sous-acromio-humérien" (Plate 266).

COUES describes the clavicular portion of the deltoid as part of the P. major (see *ante*), and describes as "anterior part of the deltoid," the true epicoraco-humeral; he describes a scapular portion.

WESTLING makes the following remarks on the pectoral and deltoid:—"The anterior portion of the deltoid presents a noteworthy similarity to the clavicular portion of the M. pectoralis of the *Ornithorhynchus*, which part as such is absent in the *Echidna*. Its origin, position and innervation point to an homology between these muscles (*i.e.*, between the anterior portion of the deltoid of the *Echidna* and the clavicular portion of the pectoralis of *Ornithorhynchus*). I must, however, leave the point undecided for further investigation whether, since the nerve supply to the P. major of *Ornithorhynchus* is furnished by a different nerve trunk, has the latter muscle originated through a blending of separate muscles, or, is the condition found in *Ornithorhynchus* the primary one, the deltoid having been differentiated from the pectoralis.

Remarks on the P. major, P. quartus, and Clavicular Deltoid.

Up to the present time, as far as we are aware, the clavicular portion of the deltoid in *Echidna* has been clearly differentiated from the pectoralis major since Mivart's paper appeared in 1866; although he did not base his conclusions on the nerve supply to the muscles. In *Ornithorhynchus*, on the other hand, the clavicular portion of the deltoid has always been taken as representing the clavicular portion of the P. major. The view that we have arrived at is as follows. That the muscle described by Mivart and others in *Echidna* as the clavicular portion of the deltoid, is the true clavicular deltoid, whilst the muscle described in *Ornithorhynchus* as the clavicular portion of the P. major is in reality the clavicular portion of the deltoid. We base our conclusions on the following points:—Origin, insertion, relations, and nerve supply; the developmental not being available.

The origins and insertions of the muscles in *Echidna* and *Ornithorhynchus* are practically identical. The relations vary slightly, inasmuch as the postero-internal border of the deltoid in *Echidna* is placed, in part, distinctly superficial (ventral) to the P. major (Fig. 3, *Dlt. C.*), while in *Ornithorhynchus* the two muscles are in the same plane, with a distinct cellular interval between their borders. Lastly, and most important of all, the nerve supply to the muscles in both animals is identical, and is derived from the representative of the circumflex nerve (*N. axillaris*), which nerve also supplies the scapular portion of the deltoid, about the homology of which there is no dispute.

As regards the muscle described by us above as pectoralis quartus, it appears that this name has not been used in connection with this muscle by any previous writer with the exception of Smith in his description of the pectoral muscles in *Ornithorhynchus*, which we have quoted above. Galton mentions *en passant* in a description of the pectoral muscles of *Dasypus* (8), that in *Ornithorhynchus* and *Echidna* "the posterior abdominal portion was naturally differentiated from the pectoral factor of the muscle," but does not call it P. quartus. Windle (23) does, however, appear to regard this muscle as P. quartus. In attempting to decide the point whether this muscle is P. quartus, or merely a posterior portion of the P. major, we can say that the origin, insertion, and relations are very similar to those described for P. quartus in other animals. But in examining the nerve supply we have found that both in *Echidna* and *Ornithorhynchus* the muscle is supplied by a branch which comes from the nerve to the P. major, *i.e.*, the external anterior thoracic. But according to Windle (23) the P. quartus should be supplied by the posterior pectoral nerve, *i.e.*, the lateral cutaneous nerve of the thorax (*N. of Wrisberg, Patterson*); or less commonly as pointed out by Bermingham (1) by the middle pectoral, *i.e.*, the internal anterior thoracic. It will be seen by referring to our figure of the brachial plexus of the *Echidna* (Fig. 13) that the nerve to the P. quartus, after leaving the nerve to the P. major, gets a communication from the second intercostal nerve, which in turn communicates with the lateral cutaneous

nerve of the thorax. It is, therefore, quite possible that although the muscle is chiefly supplied by the external anterior thoracic, it may, however, get some supply from the lateral cutaneous nerve. And indeed this would seem to be the case, for we find, in looking through some MS. notes of Professor Wilson, the following passage—"I have found the P. quartus wholly supplied in *Ornithorhynchus* by the lateral cutaneous nerve of the thorax." Furthermore, Smith has found the P. quartus in *Ornithorhynchus* supplied by a nerve coming from two roots, one from the external anterior thoracic, the other from the lateral cutaneous nerve of the thorax.

WESTLING also found that there was a connection between the nerve to the P. major and the lateral cutaneous nerve. She says—"Vom C. vii. und viii. und von dem vom D. i. und ii. entstandenen Stamme geht ein sehr starker Nerv (*vide* Fig. 17) aus, der den untern Theil des M. pectoralis major versieht und sich ausserdem in Haut- oder Hautmuskelnerven vertheilt; wahrscheinlich ist es ein N. thoracicus anterior."

Westling also remarks, in giving an account of the brachial plexus in *Echidna*, "der Nerv zu letzterm Muskel [M. pectoralis] verbindet sich mit dem einen der Hautmuskelnerven (Fig. 15, 54) die aus den hintern Wurzeln des Plexus brachialis entstehen."

Taking the above facts into consideration, it appears to us that we are quite justified in regarding the muscle under discussion as a pectoralis quartus; and if a further explanation of the nerve supply were wanted, we think that the following points from Professor Wilson's notes would aid us in comprehending the true nature of the P. quartus. Professor Wilson says—"I think it most probable that various severally distinct muscular sectors in the posterior region of the Mammalian thoracic, or from the abdominal, wall, have received the common name of pectoralis quartus; and that a whole series of transition forms exists between a condition, (*a*) in which a true pectoralis quartus appears as simply a posterior sector of the general pectoral mass arising from the mesio-ventral line, and wholly or largely distinct from a humeral

panniculus as in *Didelphys* and *Phalangista*; and a condition (*b*) such as I find in *Notoryctes* in which the P. quartus is only represented by a thickened portion of the humeral panniculus overlapping, it may be, the latissimus dorsi. The intermediate conditions (*c*) exhibit variously differentiated abdomino-humeral pannicular, or laterally placed "pectoralis quartus," slips. And in this connection may be quoted Professor Cunningham's opinion in reference to axillary muscles generally, that "in the region of the axilla there is not the same sharp well-defined subdivision between the panniculus and the deeper stratum that exists elsewhere."

P. MINOR.

Although the pectoralis minor has been mentioned by some observers, such as Meckel, Owen, Cuvier and Laurillard, and Coues, it does not appear that there is any muscle present that really represents a true pectoralis minor. The muscles that have been put forward as representatives of the P. minor, are the costo-coracoid, the sterno-epicoracoid, and the epicoraco-humeral. We shall see, however, when considering these various muscles, that other and more probable homologies have been assigned to them. (*Vide* also remarks by Humphry under M. epicoracoideus.)

M. EPICORACO-HUMERALIS.

ECHIDNA: *M. supracoracoideus*, Fürbringer, Westling; *Epicoraco-humeral*, Mivart, Leche.

ORNITHORHYNCHUS: *Anterior part of deltoid*, Meckel, Owen, Coues; *Supracoracoideus*, Westling, Fürbringer; *Epicoraco-humeral*, Leche; *Moyen petit pectoral*, Cuvier and Laurillard.

ECHIDNA.

Origin. The muscle is displayed (covered by a well-marked layer of fascia), when the anterior part of the P. major and the clavicular deltoid are reflected. It arises from the whole of the ventral face of the epicoracoid (with the exception of a small area situated postero-internally, and giving origin to the epicoracoid head of the biceps). (Fig. 4, *Ep. II.*)

Insertion. The muscle runs outwards and posterior, narrowing as it approaches its insertion on a groove on the ventral surface of the greater tuberosity, and on the outer half of the ridge which runs from the greater to the lesser tuberosity on the antero-internal face of the humerus (and bounds the concavity [bicipital groove] between the two tuberosities).

Relations. At its origin the muscle on the left side is partially hidden by the interclavicle, while on the right side in addition it is hidden by the left epicoracoid. On the ventral surface of the tuberosity the tendon of insertion is placed external to the insertion of the supraspinatus and internal to that of the P. major, being partially hidden by the P. major and claviculardeltoid; while the rest of the insertion is fleshy and is intimately related to the coraco-brachialis brevis.

ORNITHORHYNCHUS. (Fig. 7, *Ep. H.*).

Origin. The muscle arises from the ventral surface of the epicoracoid, a small space excepted, as in the *Echidna*, for the biceps origin.

Insertion. The muscle arising by fleshy fibres runs posterior and outwards over the ventral aspect of the capsular ligament of the shoulder joint, and becoming narrower as it approaches its insertion by fleshy fibres on the posterior face of the humerus, just internal to the insertions of the P. major and claviculardeltoid, and by tendon on the ventral surface of the greater tuberosity; the insertion being between that of the P. major externally and of the supraspinatus and infraspinatus internally.

Relations. The muscle at its origin is partially hidden from view by the median and transverse portions of the interclavicle. The muscle on the left side is also overlapped and hidden by the right epicoracoid (this being the opposite condition to that in *Echidna*). As it runs to its insertion it has the epicoracoid head of the biceps closely connected with its postero-internal border, while it hides the insertions of the supra- and infraspinatus.

Innervation. *N. supracoracoideus* (Fig. 13, et 16, 22 A.). Westling gives the same innervation.

ECHIDNA.

WESTLING describes this muscle under the name of *M. supracoracoideus*, following Fürbringer's nomenclature for the supposed homologous muscle in Saurians. Westling gives the origin from the ventral surface and lateral border of the epicoracoid, and the insertion: "Tuberculum majus, oberhalb der Insertion des *M. pectoralis* und medial von derselben, und lateraler Rand der Vertiefung zwischen beiden Tuberculi bis zur Insertion des *M. coraco-brachialis brevis* hinab. Innervation: *N. supracoracoideus*."

Westling then goes on to remark that the muscle is present in Saurians, and that its origin in these is, as in the Monotremes, from a well developed coracoid, and its insertion is likewise similar; and quotes Fürbringer's opinion that the homology between these muscles in the Monotremes and Saurians is undoubted.

LECHE follows Westling, and describes the muscle with the pectoral group; and also in another place under "Muskeln am Oberarme."

MIVART was the first to describe the muscle in *Echidna*, under the name of "epicoraco-humeral." After giving the origin and insertion, he says, "the muscle answers neither by its origin nor insertion to either the *P. minor* or to the *subclavius*. It is evidently the muscle described and figured by Meckel as the anterior portion of the deltoid, but in the *Echidna* we have, in addition to this muscle, another which appears to be wanting in the *Ornithorhynchus* (judging from Meckel's figures), and which is evidently the anterior part, if not the whole, of the deltoid. This muscle may be the serial homologue of the *pectineus* or of the *obturator externus*, more probably the former, on account of its insertion."

ORNITHORHYNCHUS.

OWEN describes this muscle under the name of "anterior part of the deltoid," saying that it arises "from the anterior extremity of the coracoid and is inserted on the deltoid crest."

LECHE gives the same description for the muscle as in *Echidna*.

COUES describes it under the name of "anterior portion of the deltoid," protesting, however, "that it is overlaid and covered by the pectoralis, and would hardly recall a deltoid by any physical feature."

MECKEL says—"Infra pectoralis partem anteriorem parvus ponitur musculus, quem pro deltoidis parte antica habuerim, ab ossis coracoidei quadrati extremo antico extrorsum, ad summam ossis brachii cristam anticam descendens."

CUVIER and LAURILLARD figure it on Plate 266 as "grand pectoral, portion profonde dite moyen ou petit pectoral."

Remarks. With regard to this muscle, we may dismiss at once the suggestion that it is the homologue of the subclavius.

HUMPHRY (11) describes in *Cryptobranchus* "a broad thin muscle arising from the outer surface of the sternal or epicoracoid edge of the coracoid superficial to the biceps. It crosses the muscular fibres of the biceps superficially and transversely, and converges to be inserted into the summit of the upper part of the radial tubercle of the humerus, just above the pectoral. It may be called the epicoraco-humeral." In a note on the above, he says, "it corresponds, I think, with that described under the name in the *Echidna* by Mivart." In another place Humphry says, "in animals above fishes the coraco-humerals, or, as they are more generally called, coraco-brachials, are commonly divided into segments which vary in number and size with the number and size of the coracoid processes; and they are sometimes absent when these processes are abortive, as in Mole, *Cyclothurus* and Seal. They arrange themselves in two divisions. First, those which lie superficially with regard to the biceps brachii muscle and which pass to the radial tubercle of the humerus immediately above the level of the P. major and also extend beneath that muscle. These constitute a superficial or preaxial division. . . . "The fibres of the epicoraco-humeral part of this superficial, preaxial, or supra-bicipital division of the coraco-humerals lie immediately beneath the pectoralis major in its whole course. I have remarked that

in Cryptobranch its superficial fibres are blended with the under-surface of the pectoral, and that in Crocodile the fibres that correspond with it form part of the origin of the pectoral. It thus, to some extent, occupies the place of the pectoralis minor; and if we suppose it continued upon the under surface of the pectoral, and in variable degrees segmented from that muscle, it would quite correspond with the ordinary Mammalian pectoralis minor, the proper insertion of which appears to be the radial ridge or tubercle of the humerus. It is, however, in man, and some animals, arrested wholly, or (Rat) partially, at the coracoid, and is often quite segmented from the pectoralis major. Thus, I conceive the pectoralis minor to be formed from factors of the pectoralis major, which, or some of which, represents the epicoraco-humeral of Urodelans, Reptiles, and Monotremes, and that it also in part represents, indeed is the nearest representative of, the levator humeri of Birds."

M. SUBCLAVIUS $\left\{ \begin{array}{l} \text{M. COSTO-CORACOIDEUS.} \\ \text{M. STERNO-EPICORACOIDEUS.} \end{array} \right.$

ECHIDNA: *M. costo-coracoideus*, *M. sterno-coracoideus*, WESTLING: *Subclavius*, Mivart.

ORNITHORHYNCHUS: *Subclavius* (?), *P. minor* (?), Meckel, Owen, Coues.

ECHIDNA.

Origin. (*a*) *M. costo-coracoideus*.—This muscle arises from the sternal three-quarters of the anterior border of the first rib. (Fig. 4, *A. Cc.*).

Insertion. The muscle is fan-shaped in outline, and runs forward, the fibres converging to a small tendon by which the muscle is inserted on the dorsal surface of the coracoid bone immediately adjoining the coraco-presternal arthrodia; while some of the inner fibres are attached to the postero-external part of the dorsal surface of the epicoracoid.

Relations. The dorsal aspect of the muscle is hidden in part by the sterno-coracoid, which lies internal to it; while it is placed dorsal to the origins of the coraco-brachialis longus et

brevis; and its insertion lies between the sterno-epicoracoid internally and epicoraco-brachial externally.

Origin. (b) *M. sterno-epicoracoideus*.—This muscle springs from a small portion of the inner (sternal) end of the dorsal surface of the first rib; from the outer border of the dorsal surface of the presternum; and slightly from the posterior part of the dorsal surface of the interclavicle. (Fig. 4, *A. St. C.*).

Insertion. Running forward the muscle is inserted on the anterior half of the dorsal surface of the epicoracoid.

Relations. This muscle is closely related at its origin to the inner fibres of the costo-coracoid. At its insertion it lies dorsal and internal to part of the epicoraco-brachial.

ORNITHORHYNCHUS.

Origin. (a) *M. costo-coracoideus*.—This muscle arises from the inner (sternal) two-thirds of the anterior border of the first rib. (Figs. 7 et 5, *Cc.*).

Insertion. The origin is fleshy and the muscle fan-shaped, the fibres converging as the muscle runs forward to be inserted on the whole of the dorsal rim of the coracoid adjoining the coraco-presternal arthrodia. The inner fibres of the muscle can with little difficulty be separated from the main mass, and they are seen to be inserted on the inner portion of the rim above-mentioned, and also by a tendon on the postero-external portion of the epicoracoid. The direction of the fibres of this muscle is not the same as that of the external intercostals, whose fibres run forwards and outwards.

Relations. At its origin the muscle reaches externally to the origin of the serratus from the first rib. The muscle lies, as in *Echidna*, dorsal to the epicoraco-brachial, and its internal border is somewhat covered by the *M. sterno-epicoracoideus*.

Origin. (b) *M. sterno-epicoracoideus* springs from a small area on the dorsal surface of the first rib, close to its articulation with the presternum; from the prominent ridge on the dorsal surface of the presternum (this ridge forming the rim of the coraco-presternal arthrodia).

Insertion. Running forwards and slightly inwards the muscle is inserted on the postero-internal portion of the dorsal surface of the epicoracoid.

Relations. The muscle, as in *Echidna*, lies in a plane dorsal to the costo-coracoid, and hides from view the inner part of that muscle. At its insertion its external border is closely related to the origin of the epicoraco-brachialis and insertion of the costo-coracoid.

Innervation. *Echidna*; iv. et v. cervical nerves. *Ornithorhynchus*; iv. et v. et vi. cervical nerves.

WESTLING—*Echidna*: Nn. thoracici anteriores, from v. et vi. cervical nerves: *Ornithorhynchus*, N. subclavius, from v. et (vi.?) cervical nerves. (Fig. 17, *Scl.*).

ECHIDNA.

WESTLING says:—"M. costo-coracoideus (Fürbringer) is fan-shaped and arises fleshy from almost the whole anterior border of the first rib; its fibres converge to a tuberosity on the hinder part of the dorsal face of the coracoid, on which it is inserted closely connected with the M. coraco-brachialis." Westling then remarks—"Nach Fürbringer kann man diesen Muskel sowohl mit dem gleich-benannten beim Krokodile als auch mit dem M. subclavius der höhern Säugethiere vergleichen."

Of the M. sterno-coracoideus (Fürbringer), Westling says, it arises from the dorsal face of the manubrium sterni and the sternal end of the first rib, and is inserted on to the dorsal face of the epicoracoid, "medial" from the origin of the epicoraco-brachial. Westling remarks—"Dieser Muskel steht wie der vorhergehende in näherer Beziehung zu dem M. subclavius der Marsupialien und Placentalien, und ist auch bei den meisten Sauriern gut entwickelt" (and refers to Fürbringer).

LECHE follows Westling.

MIVART says—"I could find no muscle evidently representing a pectoralis minor; but there is a small and thin muscle which arises from the anterior border of the first rib for the greater part of its length, and which is inserted into the coracoid immediately

behind (or rather above) the origin of the coraco-brachialis. I am inclined, however, to regard this muscle as the representative of the subclavius. Meckel is silent as to both, but Owen says that both a pectoralis minor and a subclavius are inserted into the coracoid in the *Ornithorhynchus*."

ORNITHORHYNCHUS.

OWEN—"The pectoralis minor is attached to the coracoid, and the subclavius is likewise inserted as in some other quadrupeds into this bone, which is no longer a subordinate process of the scapula in the Monotremes."

The above opinion is only a paraphrase of what we are now about to quote from Meckel, and Mivart is therefore in error in saying that Meckel is silent on these muscles.

MECKEL—"Scaleni, forsan et pectoralis minor, imo et subclavius, duobus, ni gravissime fallor, referuntur musculis, parvis, longitudinalibus, planis, superiore et inferiore, vicinissimis. [Sternocoracoideus] Superior, major a sterni manubrio ortus oblique extrorsum ad faciei internæ claviculæ coracoideæ quadratæ vel anterioris partem internam posticam adscendit. [Costo-coracoideus] Eodem tractu, sed a primæ costæ cartilagine inferior, minor ad claviculæ ejusdem coracoideæ faciem internam decurrit. Uterque partem scapularem deprimit, decursu igitur et actione pectoralem minorem sistit Ne quis putet, me, et subclavium huc trahentem, sententiam meam de osse quadrato coracoideo ipsum impugnare, moneo, in plurimis animalibus, etiam mammalibus, subclavium et a scapula et quidem processu coracoideo oriri."

COUES says—"Pectoralis minor? Besides the serratus another plane of muscle connects the shoulder apparatus with the top of the thorax; it has somewhat the situations and relations of an 'intercostal' betwixt first rib and the bone above. It is divisible into two parts. One of these, costo-coracoid, is larger and thicker than the other; it arises from the first rib, from the origin of the serratus magnus slip to the sternal articulation, and is inserted mainly into the base and inner surface of the coracoid. A smaller, thinner plane, manubrio-epicoracoid, expands upon the internal

surface of the epicoracoid plate. The first of these may be pectoralis minor; the second, subclavius?"

CUVIER and LAURILLARD do not show these muscles in any of their figures.

FUERBRINGER describes, under the name of *M. costo-coracoideus* in the Crocodile, a muscle, part of which agrees with the costo-coracoid above described. "Breiter ansehnlicher Muskel an der Unterseite der Brust, der sich aus zwei Portionen zusammensetzt von denen die laterale von dem Vorderrande der letzten Halsrippe (Rippe des 9 Wirbels) und die mediale von dem Vorderrande der 1 sternocostalleiste entspringt. Beide Partien vereinigen sich zu einer homogenen Schichte, die breit am ganzen Hinterrande des Coracoids inserirt." Fürbringer later on notices this resemblance and also its resemblance to the subclavius of mammals (p. 788).

In his description of the *Mm. sterno-coracoideus internus superficialis et profundus*, Fürbringer says, "die *Mm. sterno-coracoidei* der Monotremen ihrerseits stehen, wie bei der Darstellung der Schultermuskeln der Säugethiere ausführlich nachgewiesen werden soll, wieder zu dem *M. subclavius* der Marsupialia und Placentalia (besonders durch Vermittelung von dessen zu Scapula und Processus coracoideus erstreckten Varietaten) in nähere Beziehung."

M. BICEPS.

ECHIDNA: *Two parts described*, Westling, Leche; *one part only*, Mivart.

ORNITHORHYNCHUS: *Two parts described*, all authors.

ECHIDNA.

Origin. (a) *Epicoracoid head*.—This muscle arises by fleshy fibres from the postero-internal surface of the ventral aspect of the epicoracoid. Running outwards and posterior as a thin band of muscle it passes superficial to the tendon of the rectus at its insertion, and the belly then comes into contact with the anterior border of the coracoid portion. (Fig. 4, *Bc. i.*).

Origin. (b) *Coracoid head*.—This arises from the ventral face of the coracoid, from a concave surface situated between the coraco-epicoracoid arthrodia and the coraco-sternal arthrodia; also

from about one-third of the proximal portion of the upper surface of the coraco-brachialis longus. (Fig. 4, *Bc. ii.*).

I n s e r t i o n. The two portions of the biceps run out in company, coursing over a large bare surface on the antero-internal face of the humerus. The epicoracoid belly then develops a well-marked tendon, and becoming hidden by the coracoid belly it runs outwards, and twining round the humerus it is inserted on the middle third of the ulna. The coracoid portion on approaching the forearm also develops a strong tendon which is inserted on the radius distal to the insertion of the smaller belly on the ulna.

R e l a t i o n s. The epicoracoid portion at its origin is in contact with the epicoraco-humeral; it then passes superficial to the rectus tendon (inserted on the coracoid). The two parts together hide the coraco-brachialis brevis, and as they wind round the humerus they come into relation with the tendon of insertion of the clavicular deltoid.

ORNITHORHYNCHUS.

O r i g i n. (*a*) *Epicoracoid head* arises from a small area on the postero-internal portion of the ventral surface of the epicoracoid. Running outwards and posterior over the insertion of the rectus, the muscle passes across the coraco-brachialis brevis, and comes into contact with the anterior border of the coracoid belly, and passing round the humerus, distal to the insertion of the deep panniculus, it develops a tendon which soon after fuses with the tendon of the coracoid portion. (Figs. 7, 9, *Bc. i.*).

(*b*) *Coracoid head* arises by an attenuated tendon (common to it and the coraco-brachialis longus) from the external border of the distal extremity of the coracoid. Running outwards a thick rounded muscular belly develops closely adherent to the ventral surface of the coraco-brachialis longus beneath. (Figs. 7, 9, *Bc. ii.*)

I n s e r t i o n. Winding round the humerus the coracoid belly now develops a tendon, and becoming fused with the epicoracoid portion, the conjoined tendon now comes to lie between the radius and ulna, and is inserted on the middle third of the latter bone.

Relations. Both portions of the muscle cross the tendons of insertion of the latissimus dorsi on the antero-internal face of the humerus.

Innervation. N. musculo-cutaneous from the iv. v. vi. vii. cervical nerves in both animals.

WESTLING—*Echidna*: N. musculo-cutaneous from the v. et vi. cervical nerves: *Ornithorhynchus*, N. musculo-cutaneous. (Fig. 17, *Cl.*).

ECHIDNA.

WESTLING describes two bellies, a smaller one springing from the epicoracoid and inserted on the ulna, and a larger from the coracoid, springing in common with the coraco-brachialis longus, and inserted on the radius. Westling proceeds to remark that in *Ornithorhynchus* the biceps has two bellies, and that in most Saurians the biceps arises from the coracoid only and not from the scapula, and is inserted on to the radius and ulna, and refers to Fürbringer's figure of *Uromastrix spinipes*.

LECHE follows Westling, but says, "Nach welcher soll ei nur am Radius inseriren (?)."

MIVART says—"The biceps has but a single head, thus differing from the *Ornithorhynchus* [and refers to Meckel]. It is thick and fleshy near its origin, but towards its insertion expands in the direction of the long axis of the forearm. It arises mainly from the strong tendon of the coraco-brachialis, but also in part from the coracoid; and some fibres take origin from the epicoracoid. It is inserted into the radius in part, but also into the ulna as far back as the coronoid process. . . . This insertion into both radius and ulna takes place in the Pig (Meckel and Huxley), and according to Meckel it is inserted either wholly or in part into the ulna in many animals."

ORNITHORHYNCHUS.

OWEN—"The biceps brachii arises by two heads; one arises from the sternal extremity of the coracoid [epicoracoid], the other also arises from the coracoid; the common tendon is inserted into the middle of the radius."

COUES divides the two heads under the names epicoraco-radialis and coraco-radialis, "this latter becomes penniform by insertion into the tendon of the other head of the biceps; posteriorly the muscular fibres nearly reach the radius. The common insertion of the two is by a broad flat tendon into the middle third of the radius."

MECKEL says—"Margini musculi, supra secundo loco descripti, et pro deltoide antico habiti, intimo apponitur musculus longe tenuior, sed longior, ex parte intima faciei externæ ossis coracoidei majoris, anterioris versus ipsius extremum inferius, oriundus. Decurrit infra cristam ossis brachii pectoralem et tendine terete inseritur radii superficiei flexoriæ circiter in media ipsius ab utroque extremo distantia. Infra hunc musculum ab imo extremo inferiore atque externo claviculæ coracoideæ posterioris, hic cum coraco-brachiali sueto more artissime junctus, oritur musculus decuplo crassior, sed brevior, extremo anteriore recti abdominis ab eodem separatus. Infra ipsum decurrit tendo ipsius externus et inferior tendini ejusdem unitus radio circiter medio inseritur, ut uterque unum reversa sistat musculum, bicipitem, qui et decursu et actione bicipitem hominis nonnullorumque mammalium refert."

CUVIER and LAUEILLARD, in Plate 268, fig. 3, give a figure of the biceps, with the letter (*r*) affixed, "biceps ou long fléchisseur de l'avantbras (scapulo-radien, portion coracoïdienne et portion bicipitale)."

M. CORACO-BRACHIALIS et M. EPICORACO BRACHIALIS.

ECHIDNA: *M. coraco-brachialis longus et brevis*, Mivart, Leche, Westling; *M. epicoraco-brachialis*, Westling, Leche. Described but not named by Mivart.

ORNITHORHYNCHUS: *M. coraco-brachialis superior et inferior*, Owen, Meckel; *Coraco-brachialis and epicoraco-brachialis* (the latter including the *coraco-brachialis brevis*), Coues.

ECHIDNA.

Origin. (*a*) *M. coraco-brachialis longus*. (Fig. 4, *Cb. L.*).—This muscle arises from the postero-internal portion of the ventral aspect of the coracoid, and from the posterior border of that bone.

I n s e r t i o n. The muscle runs outwards, upwards and posterior to be inserted close to the inner condyle of the humerus, and on the distal two-thirds of a ridge which reaches from this condyle to the distal extremity of the pectoro-deltoid ridge.

R e l a t i o n s. The origin is tendinous and thin, but towards the insertion the muscle becomes of considerable bulk. Ventro-anteriorly the coracoid belly of the biceps is closely connected with the muscle, while postero-internally the muscle lies close to the costæ.

O r i g i n. (*b*) *M. coraco-brachialis brevis.* (Fig. 4, *Cb. B.*).—This muscle lies deeper than the longus. It arises from the posterior angle and border of the coracoid in common with part of the coraco-brachialis longus.

I n s e r t i o n. Running as a wide sheet of muscle upwards and outwards, it is inserted on the ventrally projecting summit of the greater tuberosity, and into a line leading from thence to the lesser tuberosity, this line bounding distally a broad shallow depression (bicipital groove) on the antero-internal face of the bone between the tuberosities. (Fig. 18, *Bc. G.*)

R e l a t i o n s. The muscle is hidden from view by the coracoid belly of the biceps, and at its insertion it is related to that part of the epicoraco-humeral inserted on the ridge bounding the bicipital groove.

O r i g i n. (*c*) *M. epicoraco-brachialis.* (Fig. 4, *A. Ep. br.*).—The muscle arises from the outer half of the dorsal surface of the epicoracoid, and from the adjoining dorsal concave surface of the coracoid.

I n s e r t i o n. The muscle runs posterior and outwards, to be inserted on the summit of the lesser tuberosity, close to the insertion of the subscapularis.

R e l a t i o n s. At its origin from the epicoracoid the muscle is related to the insertion of the sterno-coracoideus and costo-coracoideus; both muscles, however, lying in a plane dorsal to this muscle. At its origin from the coracoid it is closely related to the coraco-brachialis brevis.

ORNITHORHYNCHUS.

Origin. *M. coraco-brachialis longus.* (Figs. 7, 9, *Cb. L.*).— This muscle arises by a tendon in common with the coracoid head of the biceps from the external portion of the distal extremity of the coracoid.

Insertion. Running outwards a thin belly of muscle develops, and after passing superficial to the tendons of the two parts of the latissimus dorsi, the muscle is inserted by a narrow tendon, on a ridge running from the internal condyle towards the distal extremity of the pectoro-deltoid ridge, and lying between the antero-internal and antero-external faces of the humerus; being placed distal to the anterior part of the latissimus dorsi.

Relations. The muscle at its origin is superficial to the coraco-brachialis brevis, but on account of its narrowness it does not hide from view the brevis, as in *Echidna*.

Origin. (*b*) *M. coraco-brachialis brevis.* (Figs. 7, 9, *Cb. B.*).— This muscle arises from the concave outer border of the coracoid lying between the glenoid cavity and the origin of the coraco-brachialis longus from the distal extremity of the coracoid, and also from the ventral face of the bone immediately adjoining this concave border.

Insertion. Running outwards, the muscle is inserted on the antero-lateral face of the humerus on a ridge which runs from the greater to the lesser tuberosity, being placed immediately distal to the edge of the deep depression between the two tuberosities. Its insertion is bounded internally by the epicoraco-brachialis and teres major; externally and distally by the posterior part of the latissimus dorsi; while the epicoraco-humeral is placed external at the proximal end of the humerus.

Relations. At its origin the fibres of this muscle are intimately connected with the fibres of the epicoraco-brachialis; it likewise comes into relation with the insertion of the costo-coracoideus on the dorsal part of the distal extremity of the coracoid. Both parts of the biceps and the coraco-brachialis longus lie superficial to and partly hide it from view.

Origin (c) *M. epicoraco-brachialis*.—This muscle arises by fleshy fibres from the outer two-thirds of the dorsal surface of the epicoracoid, and by a few fibres from the ligament which binds the antero-external angle of this bone to the dorsal surface of the interclavicle; also by some fibres from the coracoid adjoining the coraco-epicoracoid arthrodia.

Insertion. Running outwards and posterior, the muscle approaches the lesser tuberosity. A small fleshy belly with a well marked tendon is differentiated from the main mass of the muscle, and is inserted on the summit of the sesamoid bone in close relation with the tendon of the subscapularis. The remainder of the muscle now in part coalesces with the coraco-brachialis brevis, and in part is inserted by a distinct tendon on the antero-internal face of the lesser tuberosity, immediately adjoining the sesamoid bone, the insertion being surrounded by the subscapularis, teres major, and coraco-brachialis brevis; the latter muscle hiding the insertion from view.

Innervation. *Echidna*: Mm. coraco-brachialis longus et brevis, N. musculo-cutaneus; *M. epicoraco-brachialis*, from the cord formed by the iv., v., vi. and vii. cervical nerves, from which the musculo-cutaneus also springs. *Ornithorhynchus*: Mm. coraco-brachialis longus et brevis, N. musculo-cutaneus (in two divisions); *M. epicoraco-brachialis*, from the N. musculo-cutaneus, and from a cord formed from the iv., v. and vi. cervical nerves.

WESTLING—*Echidna*: Mm. coraco-brachialis longus et brevis, N. musculo-cutaneus. “Der mit dem *M. coraco-brachialis* nahe verbundene *M. epicoraco-brachialis* wird nicht direct vom N. musculo-cutaneus, sondern von einem Nerven aus denselben Cervicalnerven wie dieser, innervirt.”

WESTLING in *Ornithorhynchus* found the biceps, coraco-brachialis, and epicoraco-brachialis supplied by the musculo-cutaneus nerve.

ECHIDNA.

WESTLING says—“The *M. coraco-brachialis* is well developed and can easily be divided into three portions at its insertion, but it is more or less fused at its origin.” The parts are—(1) *M. coraco-*

brachialis longus, arising from the coracoid and inserted on the internal condyle and the anterior surface of the humerus. (2) *M. coraco-brachialis brevis*, arising from the posterior angle of the coracoid and inserted on the tuberculum minus and the anterior surface of the humerus, in the depression between the two tuberosities. (3) The *epicoraco-brachialis* (Coues), which arises from the dorsal face of the epicoracoid, and is inserted between the *M. subscapularis* and the *M. coraco-brachialis brevis* on the tuberculum minus. Westling further remarks that the *M. epicoraco-brachialis* is supplied by a nerve from the *N. musculo-cutaneus* which springs from the *Nn. cervicales v. and vi.*

LECHE follows Westling.

MIVART says, of the coraco-brachialis—"This muscle is very largely developed, and consists of at least two distinct parts, one long, and the other short. Both portions have a common origin and arise from the distal end of the coracoid, and chiefly from that part of it which looks towards the first rib. The long part passes downwards and is inserted into the internal condyle on the anterior surface of the bone. There is a good deal of tendinous fibres at the common origin; but that border of the long portion which is next the biceps is especially tendinous. The short portion is inserted into the whole anterior face of the lesser tuberosity and into part of the wide bicipital groove, and is covered by a long portion. A similar division of the coraco-brachialis appears to exist in *Ornithorhynchus* (Meckel)."

"Besides this double coraco-brachialis there is a small third portion, unless, indeed, it should be reckoned a distinct muscle. This arises from the external part of the deep or inner surface of the epicoracoid, and is inserted, by a distinct tendon, into the lesser tuberosity of the humerus, close and somewhat superficial to the insertion of the subscapularis. At its innermost part it is intimately united with the adjacent portion of the short part of the coraco-brachialis. It appears to me not improbable that it may answer to the muscle which in the common fowl arises from the inner surface of the coracoid, and is inserted into the lesser tuberosity of the humerus."

ORNITHORHYNCHUS.

OWEN says, "there are also two muscles to which the name coraco-brachialis may be applied, a superior one and an inferior one."

COUES says—"Two perfectly distinct muscles besides the one above called anterior deltoid [epicoraco-humeral] proceed from the coracoid opposite to the humerus; they have together been considered as coraco-brachialis, but the name is properly applicable to only one of them." He then proceeds to describe the coraco-brachialis proper. After this Coues describes the epicoraco-brachialis: "Much larger than the other and with different origin, course, relations and insertions; lying partly upon and partly under the whole coracoid apparatus, and upon the posterior aspect of the proximal moiety of the humerus. Viewed at first from the outside, superficially, it appears to arise from the coracoid proper, and to descend thence upon the humerus. But its real origin is much more extensive, from the whole, or nearly all, of the under (internal) surface of the epicoracoid lamella, as a thin expanded sheet whose contour is determined by that of the bony plate just named. It gains the outside by curving around the coracoid proper, reminding one of the escape of the iliacus over the pelvic brim, or of the obturator internus over the border of the ischium. It has a broad fleshy insertion into the expanded surface of the humerus, upon the aspect of that bone above noted, as far down as the insertion of the latissimus."

WESTLING says that in the *Ornithorhynchus*, according to Coues, the M. coraco-brachialis is only differentiated into two muscles, and that in Saurians there are a M. coraco-brachialis longus and a brevis, whose origins and insertions are similar to those of the *Echidna*.

LECHE says that in *Ornithorhynchus* the epicoraco-brachialis and coraco-brachialis brevis are blended into one strong muscle.

MECKEL—"Anterior, longe major, transversus, et a partis scapulæ coracoideæ facie interna fere tota, nec non ab osse quadrato, infra cavitatem scapulæ glenoideam extrorsum tendit et infra

humeri caput foveæ profundissimæ in ipsius facie posteriore pone latissimi dorsi tendinẽ inseritur. Hic, ni fallor, aut teres minor, aut, quod rectius duxerim, coraco-brachialis superior est." [Meckel's figure, Pl. v. 22, shows this muscle as the C. brachialis brevis.] "Musculus alter, posterior, certo coraco-brachialis, longior, sed tenuissimus, ex parte coracoidea extremo inferiore tendine angusto ortus, ante summum latissimum decurrens, infra eundem ossis brachii faciei anticæ, paullulum supra condylum flexorium jungitur. [In Pl. v. 25 this muscle is called coraco-brachialis inferior.]

CUVIER and LAURILLARD, in Pl. 268, fig. 4, show part of the coraco-brachialis (coraco-humérien), while in Pl. 266, fig. 2, the coraco-brachialis is shown partially hidden by biceps, but no reference number is given.

HUMPHRY says—"The deeper, post-axial, or suboccipital, coraco-humerals arise from the coracoid beneath the biceps, as best seen in Reptiles. They may be traced, in these animals, taking origin from the under and hinder surface of the coracoid and spreading upon the undersurface of the scapula, where a portion of these forms the subscapularis. In Mammals this muscle is quite segmented from the others. They are inserted into the ulna edge of the humerus; it is inserted into the ulnar tubercle. The one next below the subscapular—the coraco-brachialis medius—is generally present and is inserted into the middle of the shaft. The passage through it of the external cutaneous, or musculocutaneous, nerve indicates a tendency to division; and in several Mammals (Rabbit, Proboscis Monkey and Jerboa) the upper segment is inserted separately into the ulnar tubercle, forming a superior coraco-brachial. In Amphibians, Reptiles and Monotremes there is commonly a third segment, an inferior coraco-brachialis, which extends to the ulnar condyle; and the brachial artery, with the median nerve, passes between it and the middle coraco-brachial."

WESTLING says—"M. epicoraco-brachialis scheint mir in Bezug auf Ursprung und Insertion mit Fürbringer's M. subcoracoideus (einem Theil des M. subcoraco-scapularis) bei Chamæloniden Aehnlichkeit zu zeigen," and also "Die Saurier besitzen einen M.

coraco-brachialis longus und einen M. coraco-brachialis brevis, welche sowohl betreffs des Ursprungs wie der Insertion mit denselben bei *Echidna* übereinstimmen."

As regards the epicoraco-brachialis, we think that there are sufficient grounds for regarding it as a "coraco-brachialis." In the *Echidna* it is a very distinct separate muscle, and its nerve supply is from a branch, not from the musculo-cutaneous, but from the cord common to it and the musculo-cutaneous nerve. But in *Ornithorhynchus* the muscle is not so distinctively a separate muscle, and although the chief nerve to it corresponds to the nerve in *Echidna*, at the same time the true musculo-cutaneous nerve gives it a distinct twig. It will be seen by referring to Westling's figure (Fig. 17, *Cl.*) of the brachial plexus in *Ornithorhynchus*, that she found the muscle supplied from the musculo-cutaneous nerve alone. She says . . . "ein Nerv, der sich in die beiden Portionen des M. biceps brachii, den M. coraco-brachialis und den M. epicoraco-brachialis vertheilt."

M. INFRASPINATUS.

ECHIDNA et ORNITHORHYNCHUS: *M. infraspinatus*, all authors.

ECHIDNA.

Origin. This muscle has an extensive origin from the outer face of the scapula. The surface of bone from which it arises is bounded as follows: dorsally by the anterior part of the outer rim of the vertebral border (excepting the small area from which the clavicular deltoid arises); anteriorly by the inferior part of the spine and the outer border of the acromion; while posteriorly by the ridge from which the teres minor arises, and the upper two-thirds of the glenoid border.

Insertion. The muscle runs downwards and outwards to be inserted by a narrow tendon, as well as by muscular fibres, on the posterior face of the humerus, just internal to the proximal third of the pectoro-deltoid ridge; the insertion being hidden by the clavicular deltoid, and being in immediate relation with the insertion of the upper layer of the deep panniculus.

R e l a t i o n s. At its origin from the vertebral border of the scapula the muscle is intimately related to, and covered by, the scapular part of the deltoid, while anteriorly the acromial part of the deltoid arises close to it. The teres minor, long head of triceps, and the anterior border of the subscapularis arise close to it posteriorly. As the muscle leaves the acromion the supraspinatus comes into intimate relation with it, and as it runs to its insertion it courses over the capsular ligament and hides from view the origin of the teres minor.

ORNITHORHYNCHUS. (Fig. 8, I. S.).

O r i g i n. The infraspinatus arises from a concave space on the external face of the scapula. This space is bounded dorsally by the origin of the scapular deltoid from the anterior part of the vertebral border and upper part of the spine of the scapula; anteriorly by the lower one-third of the spine, posteriorly by the anterior border of the origin of the subscapularis, and upper half of the glenoid ridge with the origin of the long head of the triceps; the more ventral convex portion of the external face of the scapula does not, however, give origin to this muscle.

I n s e r t i o n. Arising by fleshy fibres the muscle runs downwards and outwards, and becoming narrower as it approaches its insertion, it sinks under cover of the clavicular deltoid, and winding over the capsular ligament of the shoulder joint, it is inserted chiefly by tendon on the inner portion of the ventral surface of the greater tuberosity, and by a few fleshy fibres on a small area of the posterior surface of the humerus, immediately internal to the proximal end of the delto-pectoral ridge, the insertion being placed between the insertions of the epicoraco-humeral and the supraspinatus.

I n n e r v a t i o n (*vide post*, supraspinatus).

ECHIDNA.

WESTLING describes the origin "from the dorsal face of the scapula close to the spine (the anterior border), between the deltoid ii, and the subscapularis and triceps." In remarking on

the nerve supply she says, "ein Theil des Ramus supra- und infraspinatus des N. supracoracoideus durchsetzt den M. supraspinatus und dringt in den medialen Rand des M. infraspinatus ein; hauptsächlich wird jedoch der Muskel durch mehrere Aestchen vom N. axillaris, die in die Lateralfläche eintreten, versorgt."

LECHE follows Westling, but quotes the latter part only of Westling's statement about the nerve supply.

MIVART describes the origin and insertion as given above, and remarks that "the muscle in the *Ornithorhynchus* which is figured by Meckel (tab. vii. No. 13) and named by him *deltoides*, appears to be the same as that which I have named *infraspinatus* in the *Echidna*." The muscle referred to is in Pl. VI. not Pl. VII., and is the posterior portion of the deltoid and is quite accurately figured and named by Meckel: there is, however, a mistake in this plate (see below).

ORNITHORHYNCHUS.

OWEN remarks, that "the *infraspinatus* and the *teres major* cover the whole of the external surface of the scapula."

LECHE does not mention this muscle under *Ornithorhynchus*.

COUES writes—"Infraspinatus (and *teres minor*? or the latter wanting?) occupies, and arises fleshy from, the whole of the scapular plate below the spine and spinous elevation, this is, between the last named and the origin of the scapular head of the triceps."

MECKEL—"Extorsum tres sequuntur musculi . . . secundus *infraspinatus*, medius, longe major a media scapulæ facie externa tuberi ossis humeri antico inseritur infra et extorsum a modo dicto."

CUVIER and LAURILLARD figure this muscle (in Pl. 266, fig. 2, *m*) under the name "*sous-épineux (sous-scapulo-trochitérien)*," but in fig. 1, Pl. 266, *m*, is really part of the *subscapularis*.

MECKEL (in Pl. VI. 14) figures as *infraspinatus* what is only part of the *subscapularis*. This is plainly seen to be a mistake, as the long head of the triceps is seen arising from the glenoid ridge in front of (dorsal to) the muscle represented as *infra-*

spinatus. In Pl. v. 20, the infraspinatus is rightly named and figured.

M. SUPRASPINATUS.

ECHIDNA: *M. supraspinatus*, all authors.

ORNITHORHYNCHUS: *M. supraspinatus*, all authors.

ECHIDNA.

Origin. The supraspinatus is a large well developed muscle. It arises from the ventral two-fifths of the inner surface of the scapula and acromion. Its origin is bounded anteriorly by the acromio-trachélien; dorsally by a slight ridge to which the omohyoid is attached; posteriorly by the subscapularis as it winds round the posterior border to encroach on the inner face of the scapula; the muscle does not, however, arise from the ventral portion of the inner face of the scapula immediately adjoining the coracoid.

Insertion. Winding round the sharp lower edge of the scapula between the acromion and the glenoid cavity, the muscle then becomes intimately related to the capsular ligament, and continues on posteriorly and somewhat outwards to become inserted by a well marked tendon into that portion of the greater tuberosity immediately contiguous to the articular head of the bone; the insertion being placed between the epicoraco-humeral and infraspinatus, and being hidden from view by the clavicular deltoid. (Fig. 4, *Ns.*)

Relations. The muscle in running to its insertion becomes closely related on its inner aspect to the epicoraco-humeral, and externally to the infraspinatus.

ORNITHORHYNCHUS.

Origin. The supraspinatus is a very small muscle arising by fleshy fibres from the internal face of the scapula, from a depression situated close to the sharp ventral border of the scapula that runs between the acromion and the glenoid cavity.

I n s e r t i o n. Winding round this ventral border, the small muscle runs posteriorly and outwards to be inserted, fleshy, on the ventral aspect of the inner part of the greater tuberosity. (Fig. 8, *Ss.*).

R e l a t i o n s. At its origin the muscle is placed immediately ventral to the origin of the omo-hyoid. As it runs to be inserted it enters an angle formed by the infraspinatus and epicoraco-humeral, being partially hidden by the latter muscle.

I n n e r v a t i o n. *Echidna et Ornithorhynchus*: M. supraspinatus, N. supracoracoideus; M. infraspinatus, N. supracoracoideus chiefly; while the N. axillaris also sends a small branch to the M. infraspinatus.

WESTLING notices this double nerve supply for the infraspinatus in *Echidna*; and remarks "hauptsächlich wird jedoch der Muskel durch mehrere Aestchen vom N. axillaris, die in die Lateralfläche eintreten, versorgt." In the two specimens of *Echidna* dissected by us, however, the chief nerve supply was undoubtedly from the N. supracoracoideus.

Westling further says, under N. supracoracoideus—"Der N. supracoracoideus verhält sich in der nun geschilderten Weise auf beiden Seiten der mir zu Gebote stehenden Exemplare von *Echidna*. Bei *Ornithorhynchus* hat Fürbringer eine ähnliche Anordnung des N. supracoracoideus gefunden; der wichtigste Unterschied in Bezug auf *Echidna* ist, dass der M. infraspinatus beim Schnabelthiere am öftesten ausschliesslich vom genannten Nerven versehen wird. Der N. axillaris sendet jedoch bisweilen Fädchen in besagten Muskel und kann selbst ganz und gar den Ramus supra- und infraspinatus N. supracoracoideus ersetzen; ein solcher Ausnahmefall ist in meiner Abhandlung über *Ornithorhynchus* beschrieben worden."

We doubt the accuracy of the latter part of this statement.

ECHIDNA.

WESTLING gives the origin from the ventral face of the scapula

and the clavicular border, between the acromion and shoulder joint and its insertion into the greater tuberosity.

LECHE follows Westling.

MIVART notices that "the muscle has a very extensive origin, arising as it does from almost the whole of the inner surface of the scapula not occupied by the serratus magnus." He further calls attention to the fact, "that Owen has pointed out that the supraspinous fossa is on the inner surface of the scapula."

ORNITHORHYNCHUS.

OWEN says—"The subscapularis is a narrow muscle, and narrower in reality than at first sight it appears to be, since the supraspinatus, from the inflection of the spine and acromion, arises from the same aspect of the scapula and appears to form the anterior fasciculus of the subscapularis; its distinct insertion into the anterior tubercle of the head of the humerus points out its true nature."

COUES gives an exact description of this small muscle.

LECHE merely remarks "that there is a similar muscle in *Ornithorhynchus* as in *Echidna*," and refers to Coues.

MECKEL—"Extorsum tres sequuntur musculi, . . . ex his primus, anticus, minimus, sine dubio supraspinatus, a praecedente, longe majore, tectus ab acromii facie inferiore ad capitis ossis humeri basin tendit, fortiter os attollens."

CUVIER and LAURILLARD figure this muscle (Pl. 266, fig. 2, without a reference number), as a small band running down between the epicoraco-humeral (I^2) and the infraspinaus (m).

MIVART remarks—"In the *Ornithorhynchus* this muscle must be considerably smaller than in the *Echidna*, owing to the situation of the subscapularis in that genus."

M. SUBSCAPULARIS.

ECHIDNA: *Subscapularis*, all authors.

ORNITHORHYNCHUS: Owen and Meckel describe only the portion arising from the internal face as subscapularis; part of the teres major of Coues.

ECHIDNA.

Origin. The subscapularis is large and extensive in its origin. It arises from a triangular-shaped area on the external surface of the scapula. This area is bounded dorsally by the posterior three-fourths of the outer margin of the vertebral border; anteriorly by the origin of the infraspinatus and upper half of the glenoid ridge with the origin of the long head of the triceps; posteriorly by the (actual) posterior border. But in addition to this the muscle arises from the (actual) posterior border and the inner face of the scapula immediately adjoining this posterior border; this latter origin does not, however, reach quite up to the posterior extremity of the vertebral border, nor yet quite down to the coracoid. (Fig. 10, *S. Sc.*).

Insertion. The muscle, triangular in outline and very bulky, runs downwards, backwards and somewhat inwards, to become inserted by a tendon on the ventral surface and antero-internal border of the lesser tuberosity.

Relations. The muscle at its origin is partially hidden from view by the posterior part of the trapezius, and the dermo-dorsi cervicalis. Posteriorly it is related to the teres major and a slip to the latissimus from the scapula; while that portion of its origin that extends round from the (actual) posterior border to the inner face of the scapula comes into relation with the insertion of the serratus magnus and origin of the omo-hyoid and supraspinatus. At its insertion the muscle is close to the epicoraco-brachialis and the teres minor, inserted distally on the posterior face of the humerus adjoining the lesser tuberosity.

ORNITHORHYNCHUS. (Fig. 12, *S. Sc.*).

The subscapularis has a very extensive origin from both the external and internal faces of the scapula. It arises from a triangular-shaped surface on the external face of the bone. This is bounded dorsally by the origin of the teres major from the posterior one-third of the vertebral border, and by that portion of the vertebral border between the origin of the teres major and the

scapular part of the deltoid ; anteriorly by the origin of the infraspinatus and upper two-thirds of the glenoid border and upper part of the triceps tendon ; posteriorly by the upper half of the posterior border. In addition to this the muscle arises by a still more extensive origin from the inner surface of the scapula, the area being bounded dorsally by a ridge close to the vertebral border on which is inserted the serratus magnus ; anteriorly by the true anterior costa on which is inserted part of serratus magnus, and posteriorly by the upper half of the (actual) posterior border of the scapula.

Insertion. The muscle runs downwards and inwards to be inserted on the distal extremity of the lesser tuberosity, and on a "sesamoid bone"* situated on the summit of the lesser tuberosity, close to the shoulder joint, being closely related to the insertion of the epicoraco-brachial antero-internally, and teres minor on the posterior face of the humerus.

Innervation. *Echidna et Ornithorhynchus*: N. subscapularis, from iv., v., vi. cervical nerves.

WESTLING: the same for *Echidna*.

ECHIDNA.

WESTLING describes this muscle as arising from the hinder and upper (vertebral) part of the dorsal surface of the scapula, and its insertion into the summit of the tuberculum minus humeri.

LECHE follows Westling.

MIVART says—"This large muscle has an anomalous situation, inasmuch as it is confined to the outer surface of the scapula. It arises, indeed, from the whole of the outer surface posterior to the origin of the long head of the triceps." He remarks, that, "in the *Ornithorhynchus* this muscle takes origin in part from the outer surface of the scapula, but mainly from the inner face in the usual mode."

* This so-called sesamoid bone corresponded exactly in position and relations to the epiphysis of the lesser tuberosity of the humerus of a young *Echidna*, in the writer's possession. (*Vide* fig. 18, *L.T.*).

ORNITHORHYNCHUS.

OWEN says—"The subscapularis is a narrow muscle and narrower in reality than at first sight it appears to be, since the supraspinatus from the inflection of the spine and acromion, arises from the same aspect of the scapula, and appears to form the anterior fasciculus of the subscapularis."

COUES, as stated above, describes for the subscapularis what is really *teres minor*, while under the heading of *teres major* we find a description of the subscapularis. Thus in the description of the *teres major* we have the following:—"the upper portion is still larger and has more extensive and complicated origin from both sides of the scapula, which is thus, as it were, embraced by this muscle. The outer origin is from the postero-external aspect of the scapula, and from the origin of the lower *teres* to that of the scapular head of the triceps; the inner origin is thinner and more extensive and fleshy from the whole surface of bone between the insertions of the two digitate sets of *levator scapulae*. . . . It is inserted much higher up, in immediate relation with the shoulder joint, into the posterior tubercle of the humerus, alongside the insertion of the muscle above called subscapularis [*teres minor*]. N.B.—Its tendon contains an articular sesamoid bone."

LECHE gives, for a description of the subscapularis, Coues' description of the *teres minor*; while under the heading "*teres major*," we get Coues' description of the second part of the *teres major*, *i.e.*, of the subscapularis proper.

MECKEL says—"Subscapularis, scapulae ipsius facie interna ad ossiculum, summo tuberi interno ossis humeri nonnisi capsula junctum tendit." Again Meckel describes, as the second part of the *teres major*, what is really part of the subscapularis. "Alter, ab eo tectus (*i.e.*, *teres major*), a dimidio posteriore scapulae superficiei externae ortus, ante praecedentem ad faciem posticam ossis humeri tendit, infra caput ei insertum."

CUVIER and LAURILLARD figure (in Pl. 268, fig. 4 *n.*) this muscle under the name of "*sous-scapulaire* (*scapulo-trochinien*)," the

muscle occupying the internal face of the scapula in its proper position.

M. TERES MAJOR.

ECHIDNA: *Teres major*, single, all authors.

ORNITHORHYNCHUS: *Teres major*, double = *Teres major proper* + *External part of subscapularis*, Meckel and Owen; *Teres major double* = *Teres major proper* + *External and internal parts of M. subscapularis*, Coues; a single muscle, the *teres major proper*, Cuvier and Laurillard.

ECHIDNA.

Origin. The *teres major* arises from a small area on the posterior end of the vertebral border of the scapula.

Insertion. The muscle, cylindrical in shape, runs downwards and outwards to be inserted into the distal part of a triangular flattened surface, whose base is continuous with the lesser tuberosity, and whose apex merges into the sharp internal border of the humerus.

Relations. At its origin the muscle is intimately connected with the slip from the scapula to the *latissimus dorsi*. The muscle in its course is hidden from view and cannot be seen till the *subscapularis* in front and the slip to the *latissimus* posteriorly are drawn apart. (Fig. 10). At its insertion the tendon contains a small sesamoid bone.

ORNITHORHYNCHUS. (Fig. 12, *T. M.*).

Origin. The *teres major* arises from the posterior third of the external margin of the vertebral border, and from the immediately adjoining face, of the scapula.

Insertion. The muscle runs as a fleshy belly downwards and somewhat outwards, and becoming narrower as it approaches its insertion, by a well marked tendon, about the mid-third of the inner border of the humerus, immediately distal to the insertion of the *subscapularis*.

Relations. At its origin the muscle overlies the *subscapularis* as it arises from the outer surface of the scapula. It is intimately connected with the fine tendon of insertion of the costal

part of the serratus, and also with the rhomboid insertion. The tendon of the posterior part of the trapezius overlies it, as also does the dermo-dorsi cervicalis. At its insertion its tendon lies between the short head of the triceps arising from the posterior face of the humerus, and the insertion of the coraco-brachialis brevis and epicoraco-brachialis on the antero-internal face.

I n n e r v a t i o n. *Echidna et Ornithorhynchus*: from the cord formed from the iv., v., and vi. cervical nerves, and from which the subscapular nerves also spring. (Figs. 13, 16 ; 35).

WESTLING: idem for *Echidna*.

ECHIDNA.

WESTLING describes the origin from the posterior angle of the scapula with the scapular portion of the latissimus dorsi, and its insertion distally from the tuberculum minus between the insertion of the M. coraco-brachialis brevis and the origin of the triceps, on a ridge on the humerus.

LECHE follows this description.

MIVART gives a similar description, remarking that "this muscle appears to be considerably larger in the *Ornithorhynchus*," and refers to Meckel.

ORNITHORHYNCHUS.

OWEN remarks—"The infraspinatus and the large teres major cover the whole external surface of the scapula."

COUES says—"Double; both portions of great size, and perfectly distinct. The lower, or teres major proper, arises fleshy from the posterior extremity of the scapula for about one-third of an inch; it lies at first upon the serratus magnus, and then along the superior border of the latissimus, forming a great pyramidal muscle running between the last and the upper teres, rapidly narrowing to a rather long, stout, flattish tendon that passes behind (mesiad of) the scapular head of triceps, to be inserted in the posterior ridge of the humerus, one-half inch or more above the insertion of the latissimus." Coues then goes on to describe "the upper portion," which is really the true subscapularis.

LECHE follows Coues, and accordingly describes the teres as divided into two parts.

MECKEL also describes two muscles, a "superficialis posterior, longior, sed angustior, a marginis superioris scapulæ parte posteriore ortus," and "alter ab eo tectus, a dimidio posteriore scapulæ superficiæ externæ ortus," etc., this being part of the subscapularis.

CUVIER and LAURILLARD figure this muscle single, as the "grand rond (scapulo-humerien)," Pl. 266, fig. 1; and on Pl. 268, fig. 4, the subscapularis and teres are so clearly shown that it is evident that they did not mistake the subscapularis for part of the teres major.

M. TERES MINOR.

ECHIDNA: *Teres minor*, Fewkes; *Subscapularis accessorius*, Westling, Leche; described by Mivart, but not named.

ORNITHORHYNCHUS: *Subscapularis*, Coues.

ECHIDNA.

Origin. The teres minor arises on the external face of the scapula from a slight ridge which runs from the dorso-anterior border of the glenoid cavity upwards and posteriorly to meet the glenoid ridge.

Insertion. The origin is tendinous, and the muscle running ventrally and posteriorly over that part of the external face of the scapula adjoining (dorsal to) the glenoid cavity, lies on the capsular ligament, and then passes inwards to be inserted on that part of the posterior face of the humerus situated between the proximal (ventral) extremity of the supinator ridge and the lesser tuberosity.

Relations. At its origin the muscle is hidden from view by the infraspinatus, and it arises between this latter muscle anteriorly and the long head of the triceps posteriorly. At its insertion the origin of the internal head of the triceps bounds it distally, while proximally and internally is the insertion of the subscapularis.

ORNITHORHYNCHUS.

Origin. The teres minor arises by a well developed tendon from a ridge, on the external face of the scapula, which runs from the dorso-anterior border of the glenoid cavity posteriorly and dorsally to meet the glenoid crest at the junction of its upper two-thirds with its ventral one-third.

Insertion. Running over the excavated area on the external surface of the scapula immediately anterior to the lower part of the glenoid crest, the muscle comes into relation with the capsular ligament, and running posteriorly it is inserted on the posterior border of the ventral aspect of the lesser tuberosity, lying immediately between the sesamoid bone, on which the subscapularis is inserted, and the origin of the internal head of the triceps from the proximal end of the posterior face of the humerus.

Relations. At its origin the muscle is hidden by the infraspinatus, while the origin of the long head of the triceps is immediately posterior to it.

Innervation. *Echidna et Ornithorhynchus*: from the cord formed from the iv., v., vi. cervical nerves; and in *Echidna* also from the N. axillaris.

WESTLING: idem for *Echidna*.

ECHIDNA.

WESTLING says—"The teres minor is absent as a separate muscle; and in *Echidna* and *Ornithorhynchus*, according to Sabatier, it is quite fused with the infraspinatus." Under the title of subscapularis accessorius (Testut) a description is given of the muscle above described by us as teres minor, and in a note Westling says, "von Fewkes M. teres minor benannt." The innervation is given as from "N. axillaris und ein Nerv, der aus demselben Stamm wie besagter Nerv aber mehr proximal als dieser, entsteht."

LECHE follows Westling, and accordingly states that the teres major is absent in the Monotremes.

MIVART says, under *teres minor* "this muscle appears to be wanting in the *Echidna*, unless it is represented by the muscle which I have described as the second part of the deltoid." Later on, however, he describes, without naming, "a small delicate muscle closely connected with the outer surface of the capsular ligament, arising from the external surface of the scapula, just anterior to the lowest part of the origin of the scapular head of the triceps."

ORNITHORHYNCHUS.

OWEN does not mention the *teres minor*, nor does he describe or mention the small muscle under discussion.

COUES says, under the head of "*subscapularis*," "this is what would be for most animals the usual position of the *infraspinatus*, and might be taken for the latter, were it not for its widely distant insertion into the other side of the head of the humerus." He then goes on to describe the muscle as "a small subterete fascicle arising fleshy from that part of the scapula which lies between the glenoid and head of the triceps."

LECHE, following Coues, describes this muscle under the head of *subscapularis*. "Bei *Ornithorhynchus* ist er kleiner und entspringt von dem, zwischen *Cavitas glenoidalis* und *Triceps-Ursprung* gelegenen Theil der *Scapula*"; but he does not mention this muscle under the heading of *M. subscapularis accessorius*, where he describes the corresponding muscle of the *Echidna*.

MECKEL does not appear to describe this muscle at all.

CUVIER and LAURILLARD do not figure it in any of their Plates.

Remarks. With the exception of Fewkes (5) no observer has regarded this muscle as a *teres minor*; and as we have not been able to see Fewkes' paper, we are unable to say on what grounds he bases his opinion. Westling adopts the name *M. subscapularis accessorius*, and refers to Testut. The conclusions drawn by the latter author on the origin of this muscle in animals does not, however, give support to Westling's homology, inasmuch as Testut says that the *M. subscapularis accessorius* arises between the *M. teres major* and the long head of the triceps.

This origin shows the subscapularis accessorius to belong to the group of muscles that lie ventral to the glenoid ridge. But when we examine the origin of the teres minor in Monotremes, we find that it is placed between the infraspinatus and the long head of the triceps which arises from the glenoid ridge, that is to say, that its origin is dorsal to the glenoid ridge, and therefore the muscle can have no connection with the subscapular group of muscles.

As regards its insertion, an apparent objection arises, inasmuch as the muscle, instead of being inserted on the posterior aspect of the humerus close to the greater tuberosity, is inserted on the posterior aspect of the humerus close to the lesser tuberosity. But this unusual insertion is not so irregular when we consider that the proximal end of the humerus is flattened and widened to a very great extent, and the distance between the two tuberosities is very considerable, and the insertion of this muscle stretches for some distance over this space without, however, reaching the greater tuberosity. Lastly, the muscle is supplied (in *Echidna*) from two sources. The larger nerve of supply coming from the cord common to it and the N. axillaris, whilst from the latter a small branch is given off which runs to communicate with the larger nerve above mentioned. Westling also mentions this arrangement of the nerve supply in *Echidna*; though we, ourselves, did not find it in *Ornithorhynchus*; there being no communication in this form from the N. axillaris. The nerve supply, therefore, in our opinion, though not conclusive, is strongly in favour of our view that the muscle is really a teres minor.

M. TRICEPS.

ECHIDNA et ORNITHORHYNCHUS: *Triceps*, all authors.

ECHIDNA.

The triceps arises by four heads.

Origin. (a) *Scapular portion*.—This arises from the ventral half of the glenoid ridge, and from a ridge on the coracoid just immediately posterior to the glenoid cavity.

Insertion. The origin is by a well marked tendon, and the muscle runs upwards and outwards. As it approaches its insertion the fibres, which spring from the upper part of the glenoid ridge, become superficial, while those from the lower part of the glenoid and the coracoid become deep, and thus two distinct layers are formed, the upper one being inserted on the inner two-thirds of the posterior border of the olecranon, while the deeper one is inserted on the whole posterior border of the olecranon and also on the summit (*i.e.*, dorsal surface) of the olecranon. (Fig. 10, *Trc. S.*)

Relations. At its origin the muscle is related to the infraspinatus and teres minor anteriorly, and subscapularis posteriorly.

Origin. (*b*) *External humeral head.*—This arises by a thin tendon from a spot situated between the articular head of the humerus proximally, and the origin of the supinator longus and brachialis internus distally.

Insertion. The muscle, small and narrow, runs to be inserted on the external extremity of the dorsal surface of the olecranon in conjunction with the insertion of the proximal one of the internal heads (*c*).

Origin. (*c*) *Proximal internal humeral head.*—This arises from an area on the proximal third of the internal portion of the posterior surface of the humerus. This area is bounded externally by the ventral third of the supinator ridge with the supinator longus and brachialis internus arising from it distally by the origin of the fourth head of the triceps; internally by the sharp internal border of the humerus and the insertion of the teres major, and ventrally by the insertion of the teres minor.

Insertion. The muscle is inserted on the whole length of the summit (dorsal surface) of the olecranon.

Origin. (*d*) *Distal internal humeral head.*—This arises from an area on the distal part of the internal portion of the posterior surface of the humerus. This area is bounded ventrally (proximally) by the origin of the third (*c*) head of the triceps; externally by a line parallel and close to the supinator ridge;

distally by a line running from the supinator ridge to the internal condyle and placed just proximal to the supra-condyloid foramen; internally by the sharp inner edge of the humerus.

I n s e r t i o n. The muscle is inserted in conjunction with the proximal part (*c*) on the summit of the olecranon.

R e l a t i o n s. The musculo-spiral nerve passes from the internal border of the humerus between the proximal and distal "internal humeral heads," and then passes beneath the outer head.

ORNITHORHYNCHUS.

The triceps arises by four heads.

O r i g i n. (*a*) *Scapular portion.*—This arises from the ventral three-fourths of the glenoid border of the scapula. The origin is fleshy for the most part, but becomes tendinous near the glenoid cavity. (Fig. 12, *Trc. S.*)

I n s e r t i o n. The muscle runs towards the olecranon, becoming twisted on its axis. As it approaches its insertion it becomes split into three layers; an upper, middle and deep. The upper layer is inserted on the internal one-fourth of the posterior edge of the olecranon, the middle on the external two-fifths of the posterior edge of the olecranon, and the deep on the whole length of the summit (dorsal surface) of the olecranon.

R e l a t i o n s. At its origin the muscle is placed between the infraspinatus and teres minor anteriorly, and subscapularis posteriorly.

O r i g i n. (*b*) *External humeral head.*—This arises by two narrow tendons, one from the proximal (ventral) extremity of the supinator ridge close to the articular head of the humerus; the other more externally close to the insertion of the infraspinatus.

I n s e r t i o n. The two heads run separate for a short distance and then coalesce, and the muscular fibres run towards the olecranon, where the muscle is inserted on the external one-fourth of the posterior edge and summit of the olecranon.

O r i g i n. (*c*) *Proximal internal humeral head.*—This muscle arises from the proximal half of the internal portion of the

posterior surface of the humerus; while (*d*) *distal internal humeral head* arises from the distal half of the posterior surface.

I n s e r t i o n. Both portions of the muscle are inserted on the anterior border of the summit (dorsal surface) of the olecranon. A bundle of fibres differentiated from the inner border of the "proximal internal portion of the muscle" (*c*) is inserted separately at the inner extremity of the olecranon.

I n n e r v a t i o n. N. musculo-spiral.

WESTLING—*Echidna*: branch from N. radialis profundus.

ECHIDNA.

WESTLING describes the triceps as arising from (1) the glenoid border of the scapula; (2) from the humerus in two layers, the superficial from the proximal part, the deeper from the distal part of the humerus; (3) a narrow portion associated with the superficial (of 2) and arising by a tendon just distal to the articular head of the humerus. Westling then goes on to say, "zwischen diesem Zipfel [3] und dem übrigen Theil der oberflächlichen Schichte gehen die Arteria brachialis und ein Ast des N. radialis superficialis hindurch. Der Ursprung der tiefern Schichte streckt sich weit distalwärts, wodurch deren distalen Fasern eine völlig horizontale Richtung erhalten und parallel mit dem M. epitrochleoanconeus (M. antanconeus, Coues) werden, nur durch die Nn. ulnaris und medianus von diesem Muskel getrennt. Sowohl der scapulare wie der humerale Theile inseriren fleischig an der ganzen Breite des Olecranon."

LECHE follows Westling.

MIVART describes the origin from the glenoid border of the scapula, and says that this portion is inserted by muscular fibres on to the whole breadth of the olecranon. "The humeral portion covers the entire posterior surface of the shaft of the humerus, whence alone it takes its origin, with the exception of a small and more or less distinct slip, which arises by a marked tendon from beneath the posterior part of the greater tuberosity immediately external to the origin of the supinator longus. It is inserted

in common with the scapular portion, but it forms an arch (extending from the inner condyle to the olecranon), beneath which pass the inferior profunda artery and the ulnar and median nerves. The musculo-spiral nerve passes between the tendon above-mentioned and the rest of the humeral part of the triceps."

ORNITHORHYNCHUS.

OWEN does not describe this muscle.

LECHE refers to Coues, and mentions that Coues' description differs from Meckel's.

Coues calls the long head the rectus humeri, and describes its origin from the scapula.

From the humerus he describes an internal head, vastus internus humeri, and an external head, vastus externus humeri.

MECKEL says—"Extensores antibrachii, flexibus longe fortiores, maximam massæ muscularis brachii partem sistunt. Ex quinque revera componuntur capitibus, fere omnino, etiam in insertione, distinctis. Horum duo inferiores et posteriores extremo superiore per lineæ circiter spatium uniti, a brachii facie extensoria, hic anteriore, orti, ad olecrani partem inferiorem ejusque basin tendunt. Alter alterum ita tegit, ut ille nonnisi summæ faciei anteriori, hic dimidio ipsius superiori uniatur. Tertius, ante hos positus, a scapulæ margine inferiore, statim ante cavum glenoideum oritur et, primo in extremo inferiore nonnihil tectus, medio olecrano inseritur. Quartus, hunc statim excipiens, ex eodem margine medio oritur, ipsum tegit, et cum primo in fine infimo nonnihil confluit. Quintus, ipsi vicinissimus, a scapulæ margine inferiore ortus, apici olecrani inseritur."

CUVIER and LAURILLARD, in Pl. 265 (and in other plates), show this muscle: T. triceps (scapulo-olécranien), portion scapulaire; T.' idem, portion humérale externe.

M. TRAPEZIUS.

ECHIDNA et ORNITHORHYNCHUS: *M. trapezius*, two parts, all authors.

ECHIDNA.

Origin. (*a*) *Anterior division.*—This part of the trapezius arises by a thin aponeurotic tendon, attached to a well-marked curved depression (linea temporalis) on the parietal bone; slightly from the occipital bone in the mid-line, and also from a tendinous raphe, in the mid-dorsal line, common to it and its fellow of the opposite side. (Fig. 10, *Tr. A.*)

Insertion. The muscle runs outwards, posterior and downwards, to be inserted, (*a*) on the anterior one-third of the vertebral border of the scapula; (*b*) on the inner border of the acromion; (*c*) on the outer third of the clavicle. The muscle is not inserted on to the spine of the scapula, though it is attached to it by fascia.

Relations. At its origin the tendon of the muscle is but a thin sheet, but as the muscle runs outwards it becomes thick and fleshy, and at its insertion tendinous fibres are but little seen except in the region of the acromion. The dermo-dorsi cervicalis and the dermo-brachio-cephalic bands of the panniculus lie superficial to the muscle at its origin. When the trapezius is reflected it is seen that as we approach the ventral border of the muscle (which lies superficial to the sterno-mastoid), cleavage takes place in a plane parallel to the surface from within outwards, so that a superficial and a deep layer are formed, and the ventral border of the rhomboid lies between these two layers.

The muscle lies superficial to the rhomboid. On approaching its insertion it covers the insertion of both portions of the acromio-trachelien, and becomes related to the insertion of the posterior portion of the trapezius, scapular origin of the clavicular deltoid, the origin of the infraspinatus, and the outer origin of the acromio-clavicular part of the deltoid.

Origin. *Posterior portion of the trapezius.*—This arises from the spine of the sixth dorsal vertebra, and from the dorsal spines posterior to this to about the 13th, the exact number being indefinite inasmuch as the aponeurosis of the trapezius merges posteriorly into the general dorso-lumbar aponeurosis. The muscle also arises by four distinct slips from the 9th to the 12th rib inclusive. (Figs. 10 et 11, *Tr. P.*)

I n s e r t i o n. The muscle runs forward and outwards, the aponeurosis giving way (about the level of the 7th rib) to muscular fibres which are inserted on the anterior three-fourths of the external margin of the vertebral border of the scapula.

R e l a t i o n s. Its costal origin is closely related to the origin of the dermo-dorsi-cervicalis. It lies superficial to the latissimus dorsi, and as it approaches its insertion it hides the origins of the slip to the latissimus from the scapula, of the subscapularis, and of the clavicular deltoid. (Fig. 10).

ORNITHORHYNCHUS.

O r i g i n. (*a*) The *anterior part of the trapezius* arises from the posterior of the two well-marked depressions on the parietal bone, whose direction is from without posterior and inwards to the median line, and from a ligamentous raphe common to it and the rhomboid, attached in the mid-line of the occipital crest; the posterior limit of the origin of the muscle corresponding to about the distal extremity of the spine of the axis.

I n s e r t i o n. The muscle, quadrilateral in outline, runs outwards and posterior over the lateral aspect of the head and neck, the tendon of origin giving place to a thick fleshy sheet of muscle which is inserted, (*a*) on the anterior extremity of the vertebral border; (*b*) along the inner border of the spine and acromion; (*c*) on the outer one-fourth of the anterior surface of the clavicle.

R e l a t i o n s. At its origin the brachio-cephalic band of the panniculus arises from the parietal bone immediately anterior to the trapezius, and overlies it, as does also the aponeurosis connected with the termination of the dermo-dorsi cervicalis band of the panniculus. The muscle lies superficial to the rhomboid and hides it anteriorly but not posteriorly.

O r i g i n. (*b*) *Posterior part of the trapezius* arises from the spines of the 5th to about the 13th dorsal vertebra, the exact number not being defined since the tendon of origin blends with the general dorso-lumbar aponeurosis attached to the spine in this region. Besides the spinal origin the muscle arises by fleshy

digitations from the dorsal surface of the 10th and 11th ribs, the digitations from the 10th rib being about 1.5 cm. from the median line, while that from the 11th rib lies more external. (Fig. 12, *Tr. P.*)

I n s e r t i o n. The spinous portion, which arises by tendon, soon develops into a sheet of fleshy fibres, and is then joined by the costal portions. The whole muscle now runs forward and slightly outwards, becoming narrower as it approaches the scapula, where it is inserted by a thin flat tendon on the anterior extremity of the vertebral border of the scapula; an aponeurosis, stretching from the vertebral border of its tendon, also serving to attach it to the vertebral border of the scapula.

R e l a t i o n s. At its origin from the ribs the muscle is intimately connected with the dermo-dorsi cervicalis band of the panniculus, and the erector spinæ (sacro-lumbalis), while beneath it lie the costal fibres of origin of the latissimus dorsi. The origin from the spinous processes overlies the greater part of the vertebral origin of the latissimus. As the muscle approaches the scapula it hides from view the costal portions of the serratus magnus, and then overlies in part the teres major and subscapularis, and part of the scapular deltoid. (Fig. 12).

I n n e r v a t i o n. N. accessorius, *Ornithorhynchus* and *Echidna*.

WESTLING: same for *Echidna*.

ECHIDNA.

WESTLING describes this muscle as divided into two portions, an anterior arising from the temporal and parietal bones as well as from a fascia common to it and its fellow of the opposite side; "inseririt an einem Theile des vertebralen Randes der Scapula, an einem Sehnenstrang längs der Spina Scapulæ (nicht an der Spina selbst), am Acromion und am äussersten (acromialen) Theile der Clavicula."

The posterior portion arises by tendon from the dorsal vertebræ and the 10th-12th rib, and is inserted on to the greater part of the vertebral border of the scapula.

LECHE follows Westling in her description of the first part, but in the description of the posterior portion he says, "von den Rückenwirbeln wird der 11-12 Rippe."

MIVART says—"This muscle, as in the *Ornithorhynchus* [quoting Meckel and Owen], consists of two parts. The posterior part is triangular and arises from the last eleven dorsal, and the first lumbar, vertebræ." The anterior part, he says, is inserted into the whole length of the spine and acromion, and also into the more anterior part of the vertebral margin of the scapula, and into the outermost end of the clavicle.

ORNITHORHYNCHUS.

OWEN—"The trapezius is divided into two muscles; the posterior portion is an oblong slender triangle arising by a broad tendon from the tenth and eleventh vertebræ and ribs; and inserted by a short strong tendon behind the extremity of the spine of the scapula; the anterior portion arises from the occiput and tendinous raphe connecting it with its fellow of the opposite side, and is inserted into the spine of the scapula and into the outer half of the clavicle."

COUES describes the anterior and posterior part of the muscle. "The latter part," he says, "arises from the 10th and 11th ribs by two fleshy digitations situate respectively 1' and 1½' from the back-bone; and from a broad, oval dorsal aponeurosis common to it and its fellow."

LECHE follows Meckel, and says that the anterior part arises from the occiput and ligamentum nuchæ, and that the hinder part arises from the 10th and 11th spinal processes and corresponding ribs.

MECKEL—"Cucullaris in duos, ni graviter fallor, dividitur musculos. Alter, inferior, triangulum refert valde oblongum atque tenuem, vertebra dorsali et costa decima et undecima, tendine lato oritur, dimidio inferiore latissimum tegens, sursum tendit atque tendine brevi, forti scapulæ inseritur marginis superioris fini antico." He then goes on to describe the anterior portion.

CUVIER and LAURILLARD, in Pl. 265, figure the trapezius as (*a*) trapèze ou cucullaire, portion occipitale; (*a*¹) idem, portion cervicale; (*a*²) idem, portion dorsale; and they call the whole "dorso-sous-acromien."

M. LATISSIMUS DORSI et M. DORSO-EPITROCHLEARIS.

ECHIDNA: *Anterior, posterior, and scapular portions; the latter = M. dorso-epitrochlearis, Mivart. Scapular and anterior portions; posterior portion = M. dorso-antibrachialis, Westling, Leche.*

ORNITHORHYNCHUS: *Superficial and deep portions, Owen; Latissimus dorsi, one muscle only, and a dorso-epitrochlearis, Cones; one muscle only, Meckel.*

ECHIDNA.

The latissimus dorsi is differentiated into three portions:— anterior and posterior dorsal, and scapular.

Origin. (*a*) *Posterior dorsal portion.*—This muscle arises by fleshy bundles from the 8th to the 14th rib inclusive. The fasciculi from all these ribs are well developed, except from the 14th rib, which has but a few fibres arising from it. No fibres arise from the last rib, the 15th. (Fig. 11, *Lt. D.P.*)

Insertion. The digitations run forwards and outwards and coalesce to form a broad sheet of muscle, which becomes narrower as it approaches the olecranon, and also becomes cleft into two layers. One of these, the superficial and larger division, representing the M. dorso-epitrochlearis, runs downward and is attached by tendon to the sheath of the M. flexor carpi ulnaris, which is inserted on the pisiform bone. The deeper and smaller layer is inserted on the ventral face of the inner portion of the internal condyle; being placed superficial to the insertion of the anterior division of the latissimus now to be described.

Origin. (*b*) *Anterior dorsal portion.*—This part of the latissimus arises from the 1st-10th or 11th spine of the dorsal vertebræ. The origin from the 1st-3rd is by fleshy bundles, and by the dorso-lumbar aponeurosis from the rest.

Insertion. The muscle runs outwards and a broad sheet of muscle is developed. As the muscle approaches the internal

condyle it becomes rapidly narrower, and its anterior border is now joined by a thick belly of muscle (the scapular portion of the latissimus) which arises from the posterior extremity of the vertebral border of the scapula. (Fig. 10, *Lt. D.S.*) The conjoined muscles continue on and are inserted by a well-marked flattened tendon on the posterior border of the inner part of the internal condyle; the median, ulnar, and deep radial nerves winding from within outwards over the dorsal face of the tendon. (Fig. 10, *Lt. D.A.*)

Relations. At its origin the posterior dorsal portion is intimately related to the origins of the posterior part of the trapezius, the dermo-dorsi cervicalis, and sacro-lumbalis. The anterior portion is likewise intimately related to the origin of the trapezius from the vertebræ. The scapular slip is closely connected at its origin with the origin of the teres major and insertion of the costal serratus. Both the anterior and posterior dorsal portions are triangular in outline, the anterior and posterior borders of the latter being very thin, and while the posterior border of the former is also thin, the anterior border is quite 1 cm. thick where the scapular slip joins it.

ORNITHORHYNCHUS.

Origin. (*a*) *Vertebral portion.*—This muscle arises from the spines of the 1st-9th dorsal vertebra inclusive; the origin being fleshy from the 1st-6th inclusive, but by aponeurosis from the 6th-9th spine. (Fig. 12, *Lt. D.A.*)

(*b*) *Costal portion.*—This arises by fleshy bundles from the 4th-12th rib inclusive. The fasciculus attached to the 12th rib is about 2.5 cm. from the mid-dorsal line, while each fasciculus anterior to this gradually approaches nearer to the median line. The costal bands run forward and outwards, coalescing to form a broad triangular sheet of muscle. (Fig. 12, *Lt. D.P.*)

Insertion. The portion of the latissimus arising from the spines of the vertebræ forms a triangular superficial muscle, which hides from view the antero-internal portion of the muscle formed by the coalescence of the costal fasciculi. As the vertebral and

costal portions of the muscle run outwards and forwards they become rapidly narrower. From the ventral border of the costal portion there is now given off a fasciculus of muscle, which running outwards and downwards winds round the ulnar border of the forearm to reach its dorsal surface, where it becomes intimately connected with the fascia of the *M. flexor carpi ulnaris*. This fasciculus represents the *M. dorso-epitrochlearis*. (Figs. 9, 10, *D. Ep.*) The remaining portion of the costal division develops a tendon, and running inwards and ventral to the tendon of the vertebral portion, becomes inserted on the antero-internal surface of the humerus just internal to the median third of the pectoro-deltoid ridge, and distal to the insertion of the coraco-brachialis brevis. The vertebral portion, which does not become so narrow, runs to be inserted by a well-marked flat tendon on a strongly developed ridge situated on the distal narrow portion of the antero-internal face of the humerus, reaching almost to the coraco-brachialis longus insertion on the ento-condylar ridge. (Fig. 9, *Lt. D.P.*; *Lt. D.A.*)

Relations. The digitations arising from the posterior ribs are intimately connected with the dermo-dorsi cervicalis, and the trapezius. The fibres of the sacro-lumbalis running over the ribs have the same direction as the fibres of the latissimus dorsi: no doubt this induced Owen to describe the latissimus as arising from the posterior ribs, lumbar region, and pelvis. At its insertions on the humerus the tendons are hidden from view by the biceps and coraco-brachialis longus.

Innervation. *Echidna*: Latissimus dorsi (*a*) scapular portion, from vi. cervical nerve; (*b*) anterior dorsal portion from vi. and vii. cervical nerves. (Fig. 13; 38-40.) *Ornithorhynchus*: anterior and posterior dorsal portions from vi. and vii. cervical nerves. (Fig. 16; 39-40.) *Echidna*: Dorso-epitrochlear, vii. cervical nerve. *Ornithorhynchus*: vii., viii., cervical nerves, and i. and ii. dorsal nerves.

WESTLING—*Echidna*: Scapular and anterior dorsal portions: "Die beiden Portionen des Muskels werden von zwei aus den *M. cervicales v., vi. and vii.* ausgehenden *Nn. subscapulares*

versorgt. Ausserden sendet der aus denselben Plexusnerven zum *M. dorso-antebrachialis* ausgehende Nerv einen Ast zur grössern Portion des *M. latissimus dorsi*." *Ornithorhynchus* (vide Fig. 17, *L.D. L.C.*)

ECHIDNA.

WESTLING says—"M. latissimus dorsi besteht aus zwei Theilen. Die Hauptportion entspringt sehnig von den Proc. spinosi der 11 vordern Thoracalwirbel und in etwas von der Fascia lumbodorsalis; die kleinere dagegen entspringt gemeinsam mit dem *M. teres major* vom hintern Winkel der Scapula und von der Ursprungssehne des letztern Muskels. Zu Einem Muskel vereinigt inseriren die beiden Portionen am *Condylus internus hum.* Innervation: die beiden Portionen des Muskels werden von zwei aus den *M. cervicales v., vi. und vii.* ausgehenden Nn. subscapulares versorgt. Ausserdem sendet der aus denselben Plexusnerven zum *M. dorso-antebrachialis* ausgehende Nerv einen Ast zur grössern Portion des *M. latissimus dorsi*."

In a note on the origin of the "Hauptportion," Westling quotes Alix from Testut, "le muscle grand dorsal s'attacherait à toute la série épineuse de la région dorsale."

Later on Westling writes, under *M. dorso-antebrachialis*, "Zu den Muskeln des Oberarms dürfte auch in Folge seiner Homologa ein Muskel gerechnet werden können, welcher bis auf Weiteres den Namen *Dorso-antebrachialis* führen mag. Er entspringt fleischig von den Dorsaltheilen der 8-13 Rippe, verläuft mit convergirenden Fasern gegen den *Condylus internus humeri*, über welchem er nach dem Unterarme sich biegt, um mit dessen Fascie und dem *M. flexor carpi ulnaris* sich folgendermassen zu vereinigen: ein Theil des letztgenannten Muskels befestigt sich an einer die innere Fläche des *M. dorso antebrachialis* bekleidenden Aponeurose, worauf die gemeinsame Sehne beider Muskeln am *Os pisiforme* inserirt. Vom *M. latissimus dorsi* wird der fragliche Muskel durch eine starke Fascie getrennt. Innervation: (1) der proximale Theil durch einen Nerven aus den *Nn. cervicales v., vi. und vii.*, welcher Nerv auch einen Ast zur grössern Portion

des *M. latissimus dorsi* sendet; (2) der distale Theil durch einen Ast des *N. radialis profundus*."

In a note to the above, Westling says: "Dieser Muskel ist es, welchen Fewkes *M. dermo-flexor antibrachii* benannt hat."

Westling then considers the homology of what we have described as the dorso-epitrochlear and the posterior portion of the latissimus. She admits that the dorso-epitrochlear "hat eine deutliche Ubereinstimmung mit dem bei manchen Thieren vorkommenden *M. dorso-epitrochlearis*," and goes on to say: "Der proximale Theil ist wiederum einem bei *Galeopithecus* von Leche nachgewiesenen Muskel, dem *M. dorso-brachialis*, ähnlich, der mit einem Flatterhautmuskel der Chiroptera homolog ist." Her conclusions are: "Aus dem oben Gesagten dürfte hervorgehen, dass der *M. dorso-brachialis* bei *Galeopithecus* wie dem *M. dorso-epitrochlearis* entspricht. So viel, ich weiss, kommt bei keinem andern Säugthiere als bei *Echidna* ein ähnlicher Muskel vor, nicht einmal bei *Ornithorhynchus*, der einen *M. dorso-epitrochlearis* mit Ursprung wie gewöhnlich vom *M. latissimus dorsi* besitzt."

TESTUT—"Le muscle dorso-épitrochléen chez les animaux." "Nous trouvons, chez l'*Echidné*, un muscle analogue qui a été parfaitement décrit par M. Alix; c'est un faisceau volumineux, prenant naissance sur les 10^e, 11^e, 12^e, 13^e et 14^e côtes, se dirigeant vers le coude, glissant entre l'épitrochlée et l'olécrâne et se terminant à la partie moyenne de l'avant-bras, sur un tendon qui vient se fixier sur le pisiforme. Ce tendon uni en dedans à celui du muscle cubital antérieur, s'unit en dehors à l'aponéurose anti-brachiale et, par l'intermédiaire de cette aponéurose, il se continue avec l'aponéurose palmaire."

LECHE follows Westling.

MIVART says—"There are two distinct muscles which seem to me together to represent the *latissimus dorsi*. The posterior one of these is very elongated, and is triangular in shape from its origin as far as the elbow. It arises, by digitations, from six ribs (namely, from the eighth to the thirteenth), and, becoming narrower, passes beneath the interior condyle. A little below the

middle of the forearm it becomes intimately united with the surface of the flexor carpi ulnaris. The anterior muscle is wider, but shorter than the preceding; it arises from the spines of the first eleven dorsal vertebræ, and also somewhat from the fascia lumborum. It is inserted into the inner condyle of the humerus, in union with what appears to be the dorso-epitrochlear."

Dorso-epitrochlear (?) of Mivart.—"There is a long narrow muscle arising from the posterior extremity of the vertebral margin of the scapula, and from the posterior and outer side of the tendon of origin of the teres major. It passes downwards and becomes intimately connected with the second part of the latissimus dorsi, in common with which it is inserted, by a very strong tendon, into the internal condyle of the humerus. This muscle appears to me to represent the dorso-epitrochlear. Its origin is very similar to that of the last-named muscle in the Hyrax, though its insertion is certainly different, and it might perhaps be regarded as a separate portion of the teres major."

ORNITHORHYNCHUS.

OWEN says—"The latissimus dorsi, a very long and broad muscle, arises from the spines of all the dorsal and lumbar vertebræ, and from the eleven posterior ribs; it is inserted by a broad and strong tendon into the distal half of the ulnar margin of the humerus. At its anterior part this muscle may be separated into a superficial and deep stratum."

LECHE says—"Bei Ornithorhynchus entspringt er dagegen von allen Brust- und Lendenwirbeln sowie von den 8 oder 11 hintern Rippen; inserirt an der Mitte des ulnaren Humerus-Randes; zerfällt im Insertionstheile in eine, oberflächliche und eine tiefere Schicht (Meckel). Eine etwas abweichende Schilderung giebt Coues."

COUES says—"Latissimus dorsi—noticeable for its extensive costal, and correspondingly slight spinal origin. It arises by aponeurosis for about six dorsal vertebræ (4th-9th), beginning at a point just opposite the shoulder, to which therefore the upper border passes directly transverse; most of this spinal portion is

thicker than the costal. The latter origin is by a series of fleshy slips from the 7th to the 14th ribs, in a slightly irregular curved line, the convexity of which is forward Insertion by a short wide, thin flat tendon in an oblique line upon the humerus, half way up the pectoral crest, and thence along the ento-condylar ridge to the elbow."

"*Dorso-epitrochlearis*. The forearm slip from the latissimus is very well developed. It is given off obliquely from the lower border of the muscle, a little more than an inch from its humeral insertion, and mounts upon the back of the forearm, crossing the limb over the most prominent ridge of the latter. It appears to end in fascia over the middle of the back of the forearm, but may be traced, without unduly forcing the dissection, to pretty definite insertion into the ulna itself, at about the middle of the bone. The slip is of a nearly uniform width of about a third of an inch, and is thin and flat; it has the usual action."

MECKEL—"Latissimus dorsi, musculus longissimus et latissimus, a processibus spinosis vertebrarum dorsalium lumbariumque omnium, nec non costarum inferiorum undecim parte posteriori et media ortus, ad dimidium marginis ulnaris ossis humeri inferius tendit, cui tendine lato, crasso et forti, inseritur."

CUVIER and LAURILLARD, in Pl. 266, fig. 1, show the latissimus dorsi as (I.) grand dorsal and (I') idem, portio costale; "Cuvier la désigne aussi par opposition à la portion antérieure et supérieure, qu' il appelle portion spinale." [Note to the figure.]

With regard to the divisions of the latissimus dorsi we do not hesitate to say that the view taken by Mivart, that the scapular portion of the latissimus (in *Echidna*) is the representative of the dorso-epitrochlear, is entirely wrong.

Concerning that portion of the muscle described by Mivart as "posterior dorsal," we quite agree with him, that this is part of the true latissimus dorsi, and we do not agree with the conclusions arrived at by Westling with regard to this muscle and the dorso-epitrochlear; still less do we agree with Fewkes, who regards this

portion of the latissimus as part of the panniculus, *i.e.*, *M. dermo-flexor antebraehii*.

M. RHOMBOIDEUS.

ECHIDNA et ORNITHORHYNCHUS: *M. rhomboideus*, all authors.

ECHIDNA.

Origin. The rhomboid is imperfectly divided into anterior and posterior portions. The anterior and larger portion arises by an aponeurotic tendon from the linea temporalis on the parietal bone, and from the median raphe as far back as the 5th cervical vertebra.

Insertion. The muscle runs outwards and posterior under cover of the trapezius, and is inserted along the anterior three-fourths of the vertebral margin of the scapula.

Origin. (*a*) *Posterior portion.*—This part, imperfectly differentiated from the anterior, is represented by a narrow band of muscular fibres arising from the median raphe (in intimate connection with its fellows of the opposite side) in the region of the 5th and 6th cervical spines.

Insertion. Running upwards and outwards it is inserted on the inner margin of the posterior portion of the vertebral border of the scapula; being placed between the anterior part of the rhomboid and the insertion of the costal portion of the serratus magnus.

Relations. The anterior rhomboid at its origin lies under cover of the trapezius, and has a similar thin aponeurotic tendon of origin. As it runs posteriorly it becomes fleshy and a thick sheet of muscle is developed which is continued to its insertion; tendinous fibres being developed only at the junction of the insertion of the anterior and posterior parts. From the manner in which the posterior portion is connected with its fellow of the opposite side, this part strongly resembles the transverse cervical muscle of some animals.

ORNITHORHYNCHUS.

Origin. The rhomboid may likewise be divided into anterior and posterior parts. The anterior portion arises from a curved depression on the parietal bone immediately postero-external to the depression from which the trapezius takes origin; and from the median raphe (lig. nuchæ, Meckel) common to this muscle and the anterior part of the trapezius, and which is attached to the mid point of the occipital crest: the posterior limit of this cervical origin reaching to about the spine of the 4th cervical vertebra. The posterior portion is represented by a narrow fasciculus differentiated from the anterior part, and which arises from the median raphe in the region of the 5th cervical spine.

Insertion. The fibres of the anterior part of the muscle run outwards and posterior, while the posterior fibres run outwards and somewhat forward, the whole muscle being inserted on the posterior half of the vertebral border of the scapula (with the exception of a small area close to the distal extremity of this border occupied by the costal serratus and slip to the latissimus).

Relations. The rhomboid is hidden anteriorly by the anterior part of the trapezius. Its insertion is related to the teres major externally, costal serratus posteriorly, and cervical portion of the serratus internally, while anteriorly is the acromio-trachelien.

Innervation. *Echidna*: ii., iii., cervical nerves. *Ornithorhynchus*: iii., cervical nerve.

WESTLING: same as above.

ECHIDNA.

WESTLING describes the origin from the parietal bone and the dorsal middle line of the neck, and the insertion into the greater part of the vertebral border of the scapula parallel to the insertion of the posterior portion of the trapezius. The nerve supply from ii. and iii. cervical nerves.

LECHE follows Westling.

MIVART describes the origin from the occiput and mid-line of the back of the neck, and the insertion as Westling does.

ORNITHORHYNCHUS.

OWEN says—"The rhomboid is a single muscle, but thick and long, and inserted into the narrow base of the scapula."

COUES describes the rhomboid as, "single, of large size and thick," and states its origin, and its insertion, as "broad and fleshy into the apex behind, and about one-third along the posterior border of the scapula."

MECKEL—"Rhomboides, unus tantum sed crassus, valde longus, cucullari tamen tenuior, a marginis scapulæ superioris dimidio inferiore ad occiput tendit, a cucullari tectus spatio satis amplo inseritur."

CUVIER and LAURILLARD give, in Pl. 266, fig. 1, a figure of the rhomboid, and describe it in three parts, (*c*) rhomboïde de la tête, (*c*¹) du cou, (*c*²) du dos, and they call the whole "dorso-trachélien."

M. LEVATOR SCAPULÆ ET M. SERRATUS MAGNUS.

ECHIDNA: *M. levator scapulæ*, et *M. serratus magnus*, Westling, Leche, Mivart.

ORNITHORHYNCHUS: *Costo-scapularis*, *serratus magnus s. anticus*, et *levator anguli scapulæ*, Coues; *Serratus anticus*, Meckel; *Grand dentelé*, Cuvier and Laurillard.

M. LEVATOR SCAPULÆ.

ECHIDNA.

Origin. This muscle arises from the tips of the transverse processes of six cervical vertebræ, viz., from the axis to the 7th inclusive.

Insertion. The muscular bellies from these origins spread out to form fan-shaped muscles, which are inserted on the greater part of the suprascapula, and along a narrow curved area of the inner face of the scapula adjoining the whole length of the vertebral border and the upper two-fifths of the spine.

Relations. At its origin the acromio-trachélien hides the muscle from view; at its insertion the muscle is related to the insertions of the serratus, rhomboid, and dorsal part of the acromio-trachélien.

M. SERRATUS MAGNUS.

Origin. This muscle arises from the first four ribs, the origin from the first rib being placed about .6 cm. from the spinal extremity of the rib, while the origins from the other ribs are placed successively further out.

Insertion. The four slips are collected into one belly of muscle, which is inserted on to the posterior one-sixth of the vertebral border of the scapula; the insertion being closely related to, and placed between, the origin of the teres major and scapular part of the latissimus, and the insertion of the posterior portion of the levator scapulæ internally.

Relations. At its origin the muscle is related to the digitation of the external oblique, while the slip from the first rib is related to the costo-coracoideus and scalenus. In its course the latissimus dorsi passes superficial to it, and hides it from view.

M. LEVATOR SCAPULÆ.

ORNITHORHYNCHUS.

This muscle is divided into two portions, a dorsal stratum, and a ventral stratum.

Origin. (*a*) *Dorsal portion.*—This arises by six digitations from the tips of the transverse processes of six cervical vertebræ (2nd-7th).

Insertion. The terete bands run towards the scapula and coalesce to form a single muscle, which is inserted on the posterior half of the inner edge of the vertebral border of the scapula. The bands from the second and third cervical vertebræ are intimately connected with the ventral bands from these vertebræ, while the bands from the more posterior vertebræ are connected with the serratus magnus.

Relations. At its insertion the muscle is related to the serratus magnus, rhomboid, acromio-trachelien and to the sub-scapularis.

Origin. (*b*) The *ventral portion* arises by five digitations from the transverse processes of five cervical vertebræ (2nd-6th).

Insertion. The terete bands run to the scapula; the bands from the second and the third vertebræ are inserted on the inner half of the vertebral border of the scapula, while the remaining bands are inserted on the whole length of the anterior costa, and that portion of the supraspinous fossa lying between the insertion of the ventral part of the acromio-trachelien and the true anterior costa.

Relations. At its origin the muscle is placed between the scalenus and the dorsal portion of the levator scapulæ.

M. SERRATUS MAGNUS.

Origin. This muscle arises by three digitations from the first three ribs at a point about half way between the spine and the sternum. (Fig. 7, *S.M.C.*)

Insertion. The three bands run towards the scapula and, coalescing, are inserted by a fine tendon on the inner edge, close to the posterior extremity, of the vertebral border of the scapula.

Relations. At its origin the muscle is related to the digitations of the external oblique, and the slip from the first rib is also related to the scalenus and costo-coracoideus. At its insertion it is related to the rhomboid, levator scapulæ and teres major.

Innervation. *Echidna*: levator scapulæ, from iii. cervical nerve; serratus from v. and vi. cervical nerves. *Ornithorhynchus*: levator scapulæ and serratus, iii., iv., v., vi. cervical nerves.

WESTLING—*Echidna*: ii., iii. and vi. cervical nerves.

ECHIDNA.

WESTLING gives the origin from the transverse processes of the 2nd-7th cervical vertebræ, and from the 1st-5th ribs. Insertion on to the median half of the ventral surface and vertebral border of the scapula.

LECHE follows Westling.

MIVART says of serratus magnus and levator anguli scapulæ—“These muscles together form one large and thick layer arising from the first four ribs and from the transverse processes of all the cervical vertebræ from the seventh to the axis inclusive.”

ORNITHORHYNCHUS.

OWEN does not mention these muscles.

COUES describes these muscles separately, as costo-scapularis, serratus magnus s. anticus, and levatores anguli scapulæ.

The costo-scapularis is described by Coues as arising from the first three ribs.

LECHE does not mention these muscles.

MECKEL—"Serratus anticus in musculos duos, omnino separatos, secessit. Horum superior, fere quadratus, sex fasciculis vertebræ colli inferioribus quinque et dorsi primæ inseritur, a margine scapulæ postico ortum ducens."

"Inferior, multo longior, sed angustior, triangularis ab apice scapulæ inferiore fasciculis tribus ad costas tres proficiscens, versus extremum anterius faciei earum externæ inseritur."

CUVIER and LAURILLARD, on Pl. 266, figure these muscles in fig 1, "*g*" grand dentelé (scapulo-costien). The letter (*g*) close to the letter *o* (teres major) is the costal part of the muscle, but the other *g* appears to us to be really on the deep part of the acromio-trachelien, as also shown in fig. 2.

M. STERNO-MASTOIDEUS et M. EPISTERNO-CLEIDO-MASTOIDEUS.

ECHIDNA: *M. sterno-mastoides*, all authors.

ORNITHORHYNCHUS: *Sterno-mastoid*, Owen; *Nutator capitis*, Meckel; *Sterno-mastoid et Cleido-mastoid (?)*, Coues; *Cleido-mastoidien, et Sterno-mastoidien ou trachelien*, Cuvier and Laurillard.

M. STERNO-MASTOIDEUS. (Fig. 1, *S.M.*)

ECHIDNA.

Origin. When the superficial layer of the panniculus and the fascia beneath are reflected from the sternal region, the sterno-mastoid is displayed. The muscle, closely connected with its fellow of the opposite side, has an origin from the mid-line of the mesosternum, as far back as the ventral extremity of the fourth rib, and extending forward over the presternum and posterior half of the median portion of the interclavicle.

I n s e r t i o n. From this origin the muscle runs forward and outwards as a broad band, hiding from view portion of the P. major and clavicular deltoid, then running superficial to the omohyoid and acromio-trachelien the muscle is inserted, under cover of the anterior part of the trapezius, on the temporal bone dorsal and immediately anterior to, the retro-temporal foramen.

M. EPISTERNO-CLEIDO-MASTOIDEUS. (Fig. 7, *E.C.M.*)

ORNITHORHYNCHUS.

O r i g i n. (*a*) *Superficial portion.*—This arises from the inner half of the anterior surface of the clavicle, and the anterior surface of the median portion of the interclavicle between the inner extremities of the clavicles.

I n s e r t i o n. From this origin, which is tendinous, the muscle runs forwards and outwards and dorsally over the posterior portion of the mandible and the zygomatic process, to be inserted on the dorso-anterior border of that part of the squamosal that stands out as a well-marked process from the skull.

O r i g i n. (*b*) *Deep portion (cleido-mastoideus).*—This is seen as a thin band springing from the mid-point of the anterior surface of the clavicle.

I n s e r t i o n. It runs under cover of the external border of the superficial portion, and winding round the posterior extremity of the mandible, is inserted immediately posterior to the superficial portion on the squamosal.

R e l a t i o n s. At its origin its outer border is placed close to the insertion of the anterior trapezius on the clavicle.

I n n e r v a t i o n. *Echidna*: N. accessorius and a branch from ii. cervical nerve. *Ornithorhynchus*: N. accessorius.

WESTLING —*Echidna*: N. accessorius and branch from ii. cervical nerve.

ECHIDNA.

WESTLING gives the origin from the episternum, manubrium sterni, and greater part of the sternum; and the insertion by

means of a tendon on the cranium anterior to and above the meatus. She then states that the *M. cleido-mastoideus* is absent.

LECHE follows Westling.

MIVART describes the origin and insertion, and then remarks—“It is an interesting fact that the sterno-mastoid does not arise from the anterior border of the shoulder-girdle, but as it were follows its own normal point of attachment (the manubrium) backwards behind the episternum.

ORNITHORHYNCHUS.

OWEN describes the muscle as double on both sides.

COUES was unable to describe the origin of the muscle, as the head of his animal was injured. He remarks—“The sterno-mastoid is double on each side, unless one portion is cleido-mastoid.”

LECHE follows Coues, and expresses his opinion that the muscles are but cleft sterno-mastoids.

MECKEL describes the muscle under the name of *nutator capitis*.

CUVIER and LAURILLARD figure as (*b*¹) the cleido-mastoi-lien ou trachélien, and this is the superficial belly. On Pl. 268, fig. 2 (*b*), is called sterno-mastoidien ou trachélien, and is evidently the deeper (dorsal) belly of the muscle.

M. ACROMIO-TRACHELIEN.

ECHIDNA: *Levator clavicular*, Westling, Mivart, Leche.

ORNITHORHYNCHUS: *Levator scapule*, Meckel; *Atlanto-acromialis*, *es Atlanto-scapularis*, Coues; *Acromio-trachélien*, Cuvier and Laurillard.

ECHIDNA.

Origin. (*a*) *Dorsal portion of acromio-trachélien*.—This muscle has a small origin from the ventral aspect of the atlas; its chief origin being, however, from the basioccipital, and from the mastoid region. That portion of its origin from the atlas and occiput is connected with the tendon of origin of the muscle on the opposite side by a delicate aponeurosis stretching ventral to the atlas.

Insertion. The muscle runs posteriorly and outwards, then dorsally to be inserted on the anterior three-fourths of the inner aspect of the vertebral border of the scapula. The insertion is placed between the rhomboid externally, and serratus magnus internally; the first-named muscle hiding the insertion from view.

Origin. (*b*) *Ventral portion.*—This is smaller and is placed at its origin superficial to the portion just described. It arises from the ventral surface of the atlas close to the median line, and from a tendon which stretches between this spot and the transverse process of the axis, and forms an arch from which the muscular fibres spring.

Insertion. The muscle runs posteriorly and externally to be inserted on the whole of the inner surface of the acromion and ventral third of the spine of the scapula; also on the dorsal surface of the inner one-fourth of the clavicle; being placed under cover of the insertion of the anterior part of the trapezius.

ORNITHORHYNCHUS.

Origin. (*a*) *Dorsal portion.*—This arises by a thin flat tendon from the external border of the distal extremity of the hypapophysis of the atlas.

Insertion. The muscle runs posteriorly and outwards, becoming much broader and passing superficial to the prevertebral region is inserted on the upper part of the spine and anterior half of the vertebral border of the scapula; the insertion being placed between the serratus magnus internally, rhomboid posteriorly, and the anterior part of the trapezius antero-externally.

Origin. (*b*) *Ventral portion.*—This is placed superficial to the dorsal portion, and arises by a narrow flat tendon from the ventral surface and distal extremity of the hypapophysis of the atlas; being intimately related with the tendon of the dorsal portion, and also with the scalenus which arises from the hypapophysis.

Insertion. The muscle runs posteriorly and outwards, spreading out like a fan to be inserted on the lower two-thirds of the spine and the immediately adjacent inner surface of the

scapula, and on the inner border and surface of the acromion and the distal part of the dorsal face of the clavicle; the trapezius being placed antero-externally, and the serratus magnus postero-internally, and omohyoid ventro-internally to the insertion.

I n n e r v a t i o n. *Echidna*: Dorsal portion, ii. cervical nerve; ventral portion, iii. cervical nerve. *Ornithorhynchus*: Both portions, iii. cervical nerve.

WESTLING—*Echidna*: “Die beiden Theile des Muskels werden von den Aesten der 2 und 3 Halsnerven.”

ECHIDNA.

WESTLING, under levator claviculæ, says—“This muscle is well developed and is divided into two portions, which are intimately related along the mid-line at their origins. One portion arises from the ventral surface of the atlas and the transverse process of the following vertebra, and is inserted on the acromion and the clavicle. The other portion arises from the basis cranii “caudal vom Ohre und dem Foramen jugulare,” and is inserted on the anterior part of the vertebral border of the scapula. The nerve supply to both portions of the muscle is from the ii. and iii. cervical nerves; the same nerves supplying the rhomboid.

LECHE follows Westling.

MIVART says, under levator claviculæ (?)—“There are two flat and rather thin bands of muscular fibre which are closely connected at their origin, and together appear to represent this muscle.” He then describes the muscles; the superficial one being thin, which is inserted on the clavicle.

ORNITHORHYNCHUS.

OWEN does not mention this muscle.

COUES says—“We have two distinct muscles, both arising from the spine of the atlas hypapophysis, but with separate scapular attachments; each of these is a single belly.” He then describes the two parts under the names “atlanto-acromialis” and “atlanto-scapularis.” Of the latter muscle he says, “it has somewhat the appearance of an enlarged and distinct fasciculus of the levator

proper, with which it is inserted, fleshy on to the antero-internal surface and upper border of the scapula near its apex."

LECHE follows Coles and Meckel, and describes two portions under the names "P. ventralis," inserted on the crista scapulæ, and "P. dorsalis," inserted on the basis scapulæ.

MECKEL says, "levator scapulæ in duos divisus videtur." He then gives a full description of the two parts.

CUVIER and LAURILLARD, in Pl. 266, fig. 2, show the superficial one of these muscles as "*d*" the omo- ou acromio-trachélien, and it appears to us that the letter (*g*) quite close to (*d*) is on the deeper part of these muscles, although (*g*) is taken as part of the serratus magnus, and is called grand dentele (scapulo-costien).

M. OMO-HYOIDEUS.

ECHIDNA et ORNITHORHYNCHUS: *Omo-hyoid*, all authors except Meckel; *Omo-mylo-hyoideus*, Meckel.

ECHIDNA.

Origin. The omo-hyoid arises from a ridge on the inner face of the scapula immediately distal to the dorsal border of the origin of the supraspinatus.

Insertion. Passing forwards and inwards under the acromio-trachélien and sterno-mastoid, then under the large sub-maxillary gland, the muscle approaches the hyoid. It now splits into a superficial and a deep layer. The deep (dorsal) layer is the smaller, and is inserted on the basihyal; the superficial (ventral) is continued on and is inserted chiefly into a median raphe common to it and the stylohyoid; some of the fibres, however, are lost in the aponeurosis covering this region.

There is no tendinous intersection in this muscle.

ORNITHORHYNCHUS.

Origin. The muscle arises from the inner surface of the scapula from a small area situated between the origin of the supraspinatus and the ventral extremity of the true anterior costa.

Insertion. Running forwards and inwards a tendinous intersection crosses the muscle, running from within outwards and posteriorly. This is not seen distinctly until the muscle is reflected, and then it is further seen that anterior to the intersection the muscle is cleft into two layers. The deeper (dorsal one) is inserted on the basihyal, while the superficial (ventral) one is continued on and is inserted into a tendinous intersection common to it and the mylohyoid and stylohyoid; some of the fibres being, however, continuous without interruption with those of the mylohyoid, while a few fibres are inserted on the ceratohyal.

ECHIDNA.

WESTLING gives the origin from the scapula between the supraspinatus and the acromio-trachelien, and says that as in *Ornithorhynchus* it has no tendinous intersection. Its anterior extremity is split into two layers, the dorsal one of which is inserted on the larynx and the hyoid "die ventrale vereinigt sich mittelst Aponeurose mit den übrigen Zungenbeinmuskeln, um sich an die Basis der Zunge zu heften."

LECHE follows Westling.

MIVART describes this muscle.

ORNITHORHYNCHUS.

OWEN merely mentions that "the omohyoid and the mylohyoid have a common insertion into the hyoid."

COUES says the "mylohyoid and omohyoid are connected, if not continuous, at the hyoid bone; there is trace of a tendinous intersection, but the hyoid insertion (in the side of the body of the bone) of the two is identical, and some at least of the muscular fibres are not interrupted." In another place he says, "the omohyoid is continuous with the mylohyoid at its hyoid point of insertion, and there is no division into two bellies by a tendinous intersection, nor any confining of the muscle in its continuity by an aponeurotic pulley. Above it is partly divisible into two fasciculi, the smaller internal one of which is inserted lower down on the hyoid than the other, and is distinct from mylohyoid."

LECHE says—"Bei Ornithorhynchus entspringt er vom Os coracoideum und von der Scapula; spaltet sich wie bei Echidna; die dorsale Schichte inserirt an der Innerfläche des Unterkiefers, die ventrale am Basihyale."

MECKEL—"Musculi ossis hyoidis . . . ex illis primus est omo-mylohyoidens. Hoc nomine venire debet musculus satis longus et latus, a parte scapulæ coracoideæ et quidem a marginis ipsius superioris dimidio minore externo oriundus. Initio simplex, infra ramo transverso ossis Tformis tectus adscendit, mox in stratum superficiale et profundum fissus. Profundum corpori hyoidis affigitur, superficiale extrorsum et antrorsum versum maxillæ inferioris faciei internæ, paullo ante ipsius extremum posticum inseritur. Quamvis musculus hic maxillæ inferiori inseratur, minime hæc ipsius pars pro mylohyoideo haberi debet, quum præter ipsum verus, mylohyoideus adsit, nec insertio, in faciem externam facta, conveniat. Caput fortiter deprimere, et os aperire valet.

"Cl. Blainvillius, nulla omo-hyoidei adesse vestigia monens, hunc musculum cum sterno-thyroideo atque hyoideo confudisse videtur."

CUVIER and LAURILLARD, in Pl. 266, fig. 2 (e), omohyoidien.

TESTUT says—"Du reste, nous voyons dans quelques espèces animales le muscle omohyöidien lui-même envoyer quelques faisceaux au-dessus de l'os hyoïde; chez l'Ornithorhynque notamment, d'après Cuvier et Duvernoy, le muscle omohyöidien est un double muscle qui s'attache au corps de l'os hyoïde et à la face interne et postérieure de la mâchoire inférieure." Testut further says that Macalister has seen a fasciculus of the omohyoid pass into the mylohyoid, after having passed over (without becoming attached to) the hyoid. Wood has noticed the union of the mylohyoid with the stylohyoid.

NERVES.

ECHIDNA. (Figs. 13, 14).

N. accessorius (4). The spinal accessory is a large nerve, and after emerging from the jugular foramen it runs posteriorly and gives off a small branch (3) which joins a twig from the second

cervical nerve, to supply the sterno-mastoid muscle (2). Continuing on its course the main trunk of the nerve receives a branch from the second cervical nerve (5), and also from the third cervical (6), and piercing through the anterior part of the trapezius it supplies it (8), and ends in the posterior portion of this muscle (7).

N. hypoglossus (13). After emerging from the skull this nerve runs towards the median ventral line, where it supplies the hyoid muscles and gives off a large branch which runs posteriorly, and receives branches from the first (13A) and second (14) cervical nerves, after which it gives off a twig to supply the omohyoid (15); and running towards the median ventral line it reaches almost to the presternum.

N. phrenicus (17) springs from the third cervical nerve. Passing posterior it obtains branches from the fourth cervical (17A) and the fifth cervical, and also two thin twigs from the nerve to the subclavius (21).

N. cervicalis i., is small, and after giving off a branch (13A) to the descending part of the hypoglossus, ends in muscular branches.

N. cervicalis ii., considerably larger than the first, gives off a branch (5) (14) to the descending part of the hypoglossus, and a branch to the spinal accessory; also one which joins a branch from the spinal accessory to the sterno-mastoid (2); a twig to a branch from the third; and some twigs which run to the auricular region; while the nerve terminates about the mid-ventral line, by breaking up into numerous fine cutaneous branches. Besides these branches the second nerve gives off a large branch which, after supplying the "dorsal part of the acromio-trachelien (11)," joins with a branch from the third cervical nerve to form the nerve to the rhomboid (9).

N. cervicalis iii. This divides into two branches. The anterior of these sends off immediately a branch which, after supplying the ventral portion of the acromio-trachelien (12), continues on, and joining the branch from the second nerve, forms the nerve to the rhomboid (9). The anterior division runs outwards and breaks up into numerous twigs which supply the side of the neck and communicate with branches from other nerves (6, 10).

The posterior division of the third nerve, after giving origin to the phrenic, sends a large branch to the levator scapulae portion of the serratus magnus (20); then a branch to the fourth cervical nerve, and then numerous cutaneous and communicating twigs to the side of the neck (6, 10).

N. cervicalis iv. This divides into two divisions. The anterior runs outwards to the lateral aspect of the neck, where it is joined by branches from the third nerve, and after this it sends branches posteriorly over the clavicular region. The posterior division runs posteriorly, and after communicating with the phrenic it joins the fifth cervical nerve.

Plexus brachialis. The brachial plexus is formed by v., vi., vii., and viii. cervical, and i dorsal nerves, together with branches from the iv. cervical and ii. dorsal nerves. After the branch from the fourth nerve has joined the fifth, there spring from the junction the following branches:—(a) A twig to the phrenic (21A). (b) The nerve to supply the costo-coracoid (21) and sterno-epicoracoid muscles (21b). This nerve runs posteriorly and inwards, giving off two twigs to the phrenic in its course; and having entered the costo-coracoid it supplies this muscle and ends in the sterno-epicoracoid. (c) The N. supracoracoideus (22) is a large trunk which takes an antero-ventral course, and emerging between the epicoraco-humeral and the supraspinatus, and having sent a branch to supply the latter (25) muscle and the infraspinatus (26), it then supplies the epicoraco-humeral (22A); it gives off a minute twig which runs towards the median line and emerges between the pectoralis major and the clavicular part of the deltoid. The remainder of the nerve stem pierces the clavicular deltoid (and may possibly give this muscle a minute branch), and then becomes cutaneous, “ramus cutaneus N. supracoracoideus” (*vide* further remarks on this nerve, *post*). (d) A cord (51) which joins cords from the vi. and vii. cervical nerves. (e) A cord (52) which joins one of the divisions into which the vi. nerve divides.

N. cervicalis vi. Before this nerve divides it sends a small branch to join a twig from the fifth nerve to supply the serratus.

The sixth nerve splits into two divisions, the dorsal one of which (53) joins the dorsal cord formed by the iv. and v. nerves; and the result is a stout trunk which gives off the following numerous branches:—

- 32, 32A. Nn. to subscapularis.
- 35. N. to teres major.
- 31. N. to teres minor.
- 27. N. axillaris.
- 28. N. to clavicular deltoid.
- 29. N. to scapular deltoid.
- 30. Twig to infraspinatus.
- 33. Cutaneous branches to arm.
- 34. N. radialis superficialis to forearm (extensor surface).

Just before this dorsal portion of the sixth joins the cord from the iv. and v. nerves, it gives out two branches; one of these merely runs to the seventh nerve, the other (38) passes posteriorly and gives off three branches, one (38A) to the scapular part of the latissimus; the second (39) to the anterior dorsal part of the latissimus; while the third goes to join a branch (39B) from the seventh nerve to supply the anterior dorsal part of the latissimus (39A), and the posterior dorsal part of the same muscle (40).

N. cervicalis vii. This nerve divides into two cords. The anterior one of them, after receiving the communication from the dorsal part of the vi., divides into two parts. One of the latter is now joined by the ventral division of the vi. nerve, and the resulting cord is joined by the ventral division formed by the junction of the iv. and v. nerves. As a result, we have a stout cord which gives off the following branches:—

- 50. N. to epicoraco-brachialis.
- 36. N. to pectoralis major, which gives off in turn

37. N. to P. quartus, which receives a branch of communication from the second intercostal.

47. N. musculo-cutaneus.

48. N. to biceps.

49. N. to M. coraco-brachialis longus.

49A. N. to M. coraco-brachialis brevis.

42. Cord to median nerve.

The second part of the anterior cord of the vii. nerve first gives a branch which communicates with the nerve to the latissimus dorsi. The cord then continues its course and gives off a large cutaneous branch (45) to the forearm (flexor surface). Then

40A. N. to the dorso-epitrochlear.

44. N. musculo-spiralis.

44A. Branch to triceps (scapular head).

44B. Branch to triceps (humeral heads).

46. N. ulnaris.

43. Cord to median nerve (41).

The posterior of the two divisions, that the seventh nerve divides into, runs to join the cord formed by the viii. cervical and i. and ii. dorsal nerves. The resulting cord (54) then divides into two main divisions (56, 57); both these divisions now break up into numerous branches, some of which are joined by twigs from the intercostal nerves, and thus is formed a very complicated network distributed over the lateral and ventral aspects of the thorax and abdomen.

This cord (54) and its numerous branches we take to be the "lateral cutaneous nerve of the thorax," of Patterson [16], who considers it to represent the "nerve of Wrisberg." In a careful dissection of the Opossum (*Trichosurus vulpecula*) recently made by us, no nerve of Wrisberg was present; the second intercostal and the third intercostal sent branches down the arm and forearm,

which did not, however, communicate with any branches distributed to the arm from the brachial plexus. The "lateral cutaneous nerve of the thorax" was present and communicated with the 3rd, 4th, 5th, 6th intercostal nerves, and also supplied the P. quartus. It came off a cord formed by the viii. cervical and first dorsal nerves, and it ended by breaking up into numerous branches, which were distributed to the abdomino-humeral panniculus.

Fürbringer discusses the supracoracoid nerve in his paper, "Zur vergleichenden Anatomie der Schultermuskeln" (pp. 718-719). He draws attention to the fact that in Saurians, where there is no true supraspinatus muscle, the supracoracoid nerve pierces the pectoral girdle through the foramen coracoideum, and supplies the supracoracoid muscle. In Mammals, however, the suprascapular nerve, which comes from the same division of the brachial plexus, pierces the scapula through the incisura (foramen) scapulæ, and supplies the supraspinatus and infraspinatus muscles, there being no supracoracoid muscle present. Lastly in the *Ornithorhynchus*, where there is neither foramen coracoideum or foramen scapulæ, the nerve trunk answering to the N. supracoracoideus and suprascapularis proceeds to the anterior part of the space between the coracoid and the scapula, and divides into a ventral and a dorsal branch; the ventral branch then supplies the M. supracoracoideus (M. epicoraco-humeralis); while the dorsal branch supplies the Mm. supraspinatus and infraspinatus, "ersterer ist ein unzweifelhaftes Homologon des N. supracoracoideus der Amphibien, Reptilien und Vögel, letzterer stimmt im Wesentlichen vollkommen mit dem N. suprascapularis der placentalen und marsupialen Säugethiere überein. Nach diesem Verhalten muss zwischen N. supracoracoideus und N. suprascapularis eine gewisse Homologie statuirt werden. Diese Homologie ist aber keine complete, denn der N. supracoracoideus versorgt ventrale, der N. suprascapularis dorsale Muskeln: der erstere hat also nähere Beziehungen zu den Rr. inferiores des Plexus brachialis, der letztere zu den Rr. superiores."

In Westling's description of this nerve in *Ornithorhynchus*, she remarks that Fürbringer describes a dorsal and ventral branch, and she goes on to say—"Diesen dorsalen Ast habe ich nicht gefunden und weiss nicht, welchen Muskeln Fürbringer die Namen Supra- und Infraspinatus giebt." In the description of the N. supracoracoideus in the *Echidna*, however, Westling gives a full account of all the branches, which account agrees with what we ourselves have found.

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EXPLANATION OF PLATES.

NERVES.

i.-viii. Nn. cervicales, 1-8.

i,C.-vii,C. Nn. costales, 1-7.

i,D.-2,D. Nn. dorsales, 1-2.

Cv. = cervical nerve.

1. Cutaneous branch from 2 Cv. to auricular region.

2. From 2 Cv. to M. sterno-mastoideus.

3. From N. accessorius to M. sterno-mastoideus.
4. N. accessorius.
5. From 2 Cv. to N. accessorius.
6. From 3 Cv. to N. accessorius.
7. N. to trapezius (posterior) from N. accessorius.
8. N. to trapezius (anterior) from N. accessorius.
9. N. to rhomboid formed by branches from 2 Cv. and 3 Cv.
10. Cutaneous branches to neck from 2 Cv. and 3 Cv.
11. Nerve to M. acromio-trachelien (dorsal portion).
12. ----- (ventral portion).
13. N. hypoglossus.
- 13A, et 14. From 1 Cv. et 2 Cv. to descending part of N. hypoglossus.
15. N. to M. omo-hyoid from descending part of N. hypoglossus.
16. Descending part of the N. hypoglossus.
17. N. phrenicus.
- 17A. communication with N. phrenicus from 4 Cv.
18. Division of 4 Cv. to 5 Cv.
19. Branches from N. phrenicus, and from 4-8 Cv., to sympathetic ganglia in neck.
20. Branches from 3 Cv. to levator scapulae.
- 20A, 20B. Branches from 5 Cv. and 6 Cv. to serratus.
21. N. to M. costo-coracoideus.
- 21A. Branch from 21 to N. phrenicus.
- 21B. N. to M. sterno-epicoracoideus.
22. N. supracoracoideus.
- 22A. N. to M. epicoraco-humeralis.
23. Cutaneous twig to median line between clavicular deltoid and P. major.
- 23A. Cutaneous branch of N. supracoracoideus which pierces deltoid.
24. Twig (to clavicular deltoid ?).
25. N. to M. supraspinatus.
26. N. to M. infraspinatus.
27. N. axillaris.
28. N. to deltoid (clavicular portion).
29. N. to deltoid (scapular portion).
30. Twig to M. infraspinatus.
31. N. to teres minor and with twig from N. axillaris.
- 32, 32A. Nn. to M. subscapularis (these communicate).
33. Cutaneous branches to forearm.
34. N. radialis superficialis.
35. N. to teres major.
36. N. to pectoralis major.
37. N. to pectoralis quartus from 36.
- 37A. Branch to 37 from second intercostal.
38. N. to latissimus dorsi.
- 38A. N. to scapular portion of latissimus.
- 39 et 39A. N. to anterior dorsal portion of latissimus.
- 39B. Branch from 7 Cv.
40. N. to posterior dorsal portion of latissimus.
- 40A. N. to M. dorso-epitrochlearis.
41. N. medianus.
42. Outer (?) head of N. medianus.
43. Inner (?) head of N. medianus.
44. N. musculo-spiralis.

- 44A. N. to M. triceps (scapular portion).
 44B. ————— (humeral portion).
 45. N. cutaneus medius (Westling).
 46. N. ulnaris.
 47. N. musculo-cutaneus.
 48. N. to M. biceps (both heads).
 49. N. to M. coraco-brachialis longus.
 49A. N. to M. coraco-brachialis brevis.
 50. N. to M. epicoraco-brachialis.
 50A. Twig from M. musculo-cutaneus to M. epicoraco-brachialis (*Ornithorhynchus*).
 51. Ventral cord from 4 Cv. et 5 Cv. to ventral cord from 6 Cv. et 7 Cv.
 52. Dorsal cord from 4 Cv. et 5 Cv. to join 53 (dorsal cord from 6 Cv).
 54. Lateral cutaneous nerve of the thorax (= N. of Wrisberg?) and formed by 55 from 7 Cv. and 58 from 8 Cv. et 1 D. et 2 D.
 56 et 57. Principal divisions of 55, to supply abdomino-humeral panniculus.

MUSCLES.

- Ab. F.* Fascia covering the abdominal muscles.
Bc. i. Epicoracoid portion of M. biceps brachii.
Bc. ii. Coracoid " " "
Cb. B. M. Coraco-brachialis brevis.
Cb. L. ————— longus.
Cc. M. costo coracoideus.
D. D. C. M. dermo-dorsi-cervicalis.
D. Ep. M. dorso-epitrochlearis.
Dlt. C. Clavicular portion of M. deltoideus.
Dlt. Cx. Deep portion of the insertion of *Dlt. C.*
Dlt. S. Scapular portion of M. deltoideus.
E.C.M. M. episterno-cleido-mastoideus.
Ep. H. M. epicoraco-humeralis.
Ex. O. M. obliquus externus abdominis.
I. S. M. infraspinatus.
Lt. D.A. M. latissimus dorsi, anterior dorsal portion.
Lt. D.P. ————— posterior portion.
Lt. S. ————— scapular portion.
Pn. M. panniculus carnosus.
Pn. A. ————— abdominal portion.
Pn. D¹. ————— upper division of deep layer.
Pn. D¹¹. ————— deep —————
Pn. D¹¹¹. ————— middle —————
Pn. S. M. panniculus carnosus, superficial layer.
Pn. S. E. ————— external part of superficial layer.
Pn. S. M. ————— median part of superficial area.
Pt. M. M. pectoralis major.
Pt. Q. M. pectoralis quartus.
Pt. Q. i. ————— (deep part of insertion).
Py. M. pyramidalis.
Rect. M. rectus abdominis.
Rect.¹ ————— deep portion
Rh. M. rhomboideus.
S. L. M. sacrolumbalis.
S. M. M. sterno-mastoideus

- S. Sc. M.* subscapularis.
S. S. M. supraspinatus.
T. M. M. teres major.
Ti. Tendinous intersection in *P. major*.
Tr. A. *M. trapezius*, anterior portion.
Tr. P. ————— posterior portion.
Trc. S. *M. triceps*, scapular portion.
Trc. H. ————— humeral portion.

DESCRIPTION OF FIGURES.

- Fig. 1. —(*Echidna*). The abdominal panniculus (*Pn. A.*) is seen running forward and dividing into a superficial (*Pn. S.M.*, *Pn. S.E.*) and a deep layer (*Pn. D. i.*); this latter part runs to be inserted on the greater tuberosity, and constitutes a "dermo-flexor brachii." The clavicular deltoid (*Dlt. C.*) is seen superficial to the pectoralis major (*Pt. M.*). *Gl.* is a large gland, superficial to the sterno-mastoid (*S.M.*). The *P. quartus* (*Pt. Q.*) is seen quite distinct from the *P. major* (*Pt. M.*) and lying superficial to its postero-external border.
- Fig. 2. —(*Echidna*). The deep portion of the panniculus (*Pn. D. i.*) shown in fig. 1 is raised, and its deep layer is shown (*Pn. D. ii.*). Between these two layers lie the *P. quartus* (*Pt. Q.*) and *P. major* (*Pt. M.*).
- Fig. 3. —(*Echidna*). The deep layer of the panniculus (*Pn. D. i.*) is pinned back, and the cleft tendon of insertion of the *P. quartus* is shown (*Pt. Q.*, *Pt. Q. i.*) embracing the tendon of insertion of the *P. major* (*Pt. M.*). The edge of the latter muscle is shown to be placed deeper than the postero-internal edge of the clavicular deltoid (*Dlt. C.*) The *P. quartus* is seen arising in part from the metasternum (*Mt.S.*), but chiefly from the aponeurosis of the external oblique (*Ex. O.*). The pyramidalis (*Py.*) is shown to be inserted on the metasternum, and the rectus is seen cleft into a superficial (*Rect.*) and a deep layer (*Rect'*). *Cl.* is the clavicle; *I. Cl.* the interclavicle or episternum.
- Fig. 4. —(*Echidna*). The *P. major*, *P. quartus*, and deep panniculus are reflected; and the manner in which the latter muscle embraces the other two is shown. The clavicular deltoid (*Dlt. C.*) is raised, and we thus see the epicoraco-humeral (*Ep. H.*), and the supraspinatus (*S. S.*). The epicoracoid head and the coracoid head of the biceps have been cut through, and the relation of the former to the tendon of the rectus (*Rect.*) is shown. The coraco-brachialis brevis is seen inserted into the humerus. The relation of the two parts of the biceps as they run to be inserted is shown to the right of the figure.
- Fig. 4A.—(*Echidna*). Outline from Westling, *Taf. ii.*, fig. 6. *Ep.* epicoracoid. *Ep. St.* episternum. *M. St.* manubrium sterni. *R i.*,

Rii., Ribs i. and ii. *Cc.* M. costo-coracoideus. *S.Sc.* M. subscapularis. *S. Sp.* M. supraspinatus. *St. C.* M. sternocoracoideus. *Ep. br.* M. epicoraco-brachialis. *Sp. C. N.* supracoracoideus. *Sp. C'*. branch to the M. supracoracoideus (epicoraco-humeral). *Sp. S.* branch to M. supraspinatus and M. infraspinatus. *r. c.* ramus cutaneus.

Fig. 5. —(*Ornithorhynchus*). The clavicular portion of the deltoid (*Dlt. C.*) is shown marked off from the anterior part of the P. major (*Pt. M.*) The tendinous intersection (*Ti.*) mentioned in the description of the muscle is shown, and the direction of the fibres of the muscle which are inserted in this intersection. The P. quartus is shown quite distinct from the P. major. The thick fascia (*Ab F.*) covering the abdominal muscles, and in which the branches of the intercostal and lateral cutaneous nerves of the thorax ramify, is shown reflected. The abdominal portion of the panniculus is seen as a single layer (*Pn. A.*), while anteriorly it is shown divided into superficial (*Pn. S.*) and deep portions (*Pn. D. i.*, *Pn. D. ii.*). The costo-coracoideus muscle (*Cc.*) is represented arising from the first rib.

Fig. 6. —(*Ornithorhynchus*). This figure shows the deep layer of the panniculus (M. dermo flexor brachii) running to its insertion on the humerus. It is seen divided into three strata. A superior (*Pn. D. i.*) closely connected with the insertion of the P. major, and lying superficial to that muscle; a middle (*Pn. D. iii.*) stratum connected with the termination of the P. quartus (*Pt. Q.*) on the P. major; and a deep stratum which joins the P. major forming an inverted Λ ; a tendinous intersection marks their junction (x). The P. quartus is seen not to be cleft as in *Echidna*. (Vide fig. 3.)

Fig. 7. —(*Ornithorhynchus*). The P. major (*Pt. M.*) is shown reflected from the clavicular deltoid (*Dlt. C.*), and beneath the site of the P. major is seen the epicoraco-humeral (*Ep. H.*). The two portions of the biceps are seen (*Bc. i.*, *Bc. ii.*), and a small portion of the long coraco-brachialis (*Cb. L*) is shown lying beneath (*Bc. ii.*). The coraco-brachialis brevis is a wide muscle, and is seen between (*Bc. i.* and *Bc. ii.*) and between (*Bc. ii.* and *Cc.*) The costo-coracoid (*Cc.*) is shown arising from the first rib. The nerve supplying the P. major (36) with its branch (37) to the P. quartus is seen; and also the cutaneous branch of the N. supracoracoideus (*Sp. C.*) is represented.

Fig. 8. —(*Ornithorhynchus*). The clavicular deltoid is pinned up, and its nerve of supply (28) from the N. axillaris (27) is shown; also the branch from (27) to the scapular deltoid (29). The N. supracoracoideus is seen giving off a branch (22a) to the epicoraco-humeral (*Ep. H.*), muscle; a branch (25 and 26) to supply the supraspinatus (*S.S.*) and infraspinatus (*I. S.*) muscles. A small cutaneous branch (23) is represented in the figure as running towards the median line; it comes to the surface between the clavicular deltoid and the P. major. A large branch (23a and 24) is seen entering the deltoid, to

which muscle it may give a very small branch, and it then comes to the surface and ramifies on the clavicular deltoid. The deep layer of the insertion of the deltoid is shown (*Dlt. Cx*) and between this deep layer and the superficial layer (*Dlt. C.*) is seen the insertion of the scapular portion of the deltoid (*Dlt. S.*).

Fig. 9. —(*Ornithorhynchus*). The P. major and panniculus (*Pn. D. ii.*) are seen inserted on the humerus. The two parts of the biceps (*Bc. i.*, *Bc. ii.*) are reflected, and the broad coraco-brachialis brevis is shown. The posterior portion of the latissimus dorsi (*Lt. D.P.*) is shown with the dorso-epitrochlear arising from it (*D. Ep.*), and the insertion of this portion of the latissimus is seen to be nearer the proximal end of the humerus than that of the anterior portion of the latissimus (*Lt. D. A.*).

Fig. 10. —(*Echidna*). The posterior portion of the trapezius (*Tr. P.*) is seen inserted on the vertebral border of the scapula, in close connection with the insertion of the anterior portion (*Tr. A.*). The origin of the scapular deltoid is seen (*Dlt. S.*) The scapular portion of the triceps hides the course of the subscapularis (*S.Sc.*), scapular part of the latissimus (*Lt. D. S.*), and the anterior dorsal portion of the same muscle (*Lt. D. A.*).

Fig. 11. —(*Echidna*). The origin of the posterior portion of the latissimus is seen (*Lt. D. P.*), also the origin of the trapezius (*Tr. P.*) and the dermo-dorsi-cervicalis part of the panniculus (*D. D. C.*). The sacro-lumbalis is shown (*S.l.*).

Fig. 12. —(*Ornithorhynchus*). The trapezius (*Tr. P.*) is seen arising from the vertebrae and from the ribs, and in close connection with the latter origins are the slips of origin of the dermo-dorsi-cervicalis (*D.D.C.*). The posterior portion of the latissimus (*Lt. D. P.*) and the dorso-epitrochlear (*D. Ep.*) arising from it, and inserted on the sheath of the flexor carpi ulnaris, are represented, while the anterior portion of the latissimus (*Lt.D.A.*) is seen to be superficial to the posterior portion, and to be inserted at the distal part of the humerus. The scapular and humeral parts of the triceps are seen; also the scapular part of the deltoid (*Dlt. S.*); the teres major (*T.M.*), subscapularis (*S. Sc.*), and the costal portion of the serratus magnus (*Ser. M.*), and part of the rhomboid (*Rb.*). *E. S.* is an erector spinæ: *D. L. P.* dorso-lumbar aponeurosis.

Fig. 13. —(*Echidna*).

Fig. 14. —(*Echidna*). This figure was drawn from another specimen, and it shows considerable variation from Fig. 13.

Fig. 15. (*Echidna*). This is taken from Westling. We have substituted numbers for the letters of the original figure.

Fig. 16. —(*Ornithorhynchus*).

Fig. 17. —(*Ornithorhynchus*) from Westling. *C'*, branch to panniculus. *C''*, branch to integument. *Cl. N.* to the M. biceps, M. coraco-brachialis, and M. epicoraco-brachialis. *dlt. N.*

to the anterior portion of the M. deltoid, and to the M. pectoralis major. *ld'*. N. to the M. latissimus dorsi. *md*. N. medianus. *Phr*. N. phrenicus. *Pt'*. N. to M. pectoralis major and to the integument or panniculus. *r*. the largest branch from N. radialis. *r'* N. to the integument from which a branch *Lc'* springs to supply M. latissimo-condyloideus. *r''* N. to scapular belly of the M. triceps. *r s*. nerve cord which supplies branches to M. subscapularis and M. infraspinatus. *Scl*. N. to the M. subclavius. *S.M.* N. to serratus magnus. *SS*. Nn. subcapulares. *u*. N. ulnaris.

Fig. 18. —Humerus of *Echidna* (right side). The antero-internal and antero-external surfaces are shown. The sharp supinator ridge (*Sp. R.*) is seen running up from the external condyle (*Ex. C.*) *M. S.* indicates the musculo-spiral groove. The large bicipital groove (*Bc. G.*) is also shown. *Ex. B.* is the external border continued into the pectoro-deltoid ridge (*P. D.*) at the proximal end and the supinator ridge at the distal end. *A. B.* would represent the anterior border of the bone. *G.T.*, *L.T.* greater and lesser tuberosities. *F.Sc.* Foramen supracondyloideum (The outline of this figure and the next are from Westling).

Fig. 19. —This shows chiefly the boundaries of the posterior surface. The supinator ridge is seen to terminate before it reaches the proximal extremity of the humerus (in *Ornithorhynchus* it does not), and the dotted line running between the supinator ridge and the external border indicates that the pectoro-deltoid ridge, though apparently continued into *A. B.*, should morphologically be considered to take the direction of the dotted line in Fig. 19, that is, across the musculo-spiral groove to the supinator ridge (*Sp. R.*).